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PROPOSED NATIONAL INSTITUTE OF HEALTH

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON COMMERCE UNITED STATES SENATE

SEVENTIETH CONGRESS

FIRST SESSION

ON

S. 3391

A BILL TO ESTABLISH A NATIONAL INSTITUTE OF HEALTH TO AUTHORIZE INCREASED APPROPRIATIONS FOR THE HYGIENIC LABORATORY, AND TO AUTHORIZE THE GOVERNMENT TO ACCEPT DONATIONS FOR USE IN ASCERTAINING THE CAUSE, PREVENTION AND CURE OF DISEASE AFFECTING HUMAN BEINGS, AND FOR OTHER PURPOSES

APRIL 24 and 25, 1928

Printed for the use of the Committee on Commerce

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PROPOSED NATIONAL INSTITUTE OF HEALTH

TUESDAY, APRIL 24, 1928

UNITED STATES SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON COMMERCE,
Washington, D. C.

The subcommittee met pursuant to call, in the room of the committee in the Capitol at 11 o'clock a. m., Senator Joseph E. Ransdell presiding.

Present: Senators Ransdell (chairman), Gould, Sackett, and Copeland.

The subcommittee had under consideration the following bill:

A BILL To establish a national institute of health, to authorize increased appropriations for the hygienic laboratory, and to authorize the Government to accept donations for use in ascertaining the cause, prevention, and cure of disease affecting human beings, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Treasury is authorized and directed to establish and operate a national institute of health under the jurisdiction of his department and the administrative control of the Surgeon General of the Public Health Service, which shall be devoted to scientific research in the fundamental problems of the diseases of man and matters pertaining to health. The Secretary is authorized to select a site on land owned by the Government and available for this purpose, or to acquire a site by purchase, condemnation, or otherwise, in or near the District of Columbia, and to erect thereon suitable and necessary buildings, including furniture and equipment for the use of such institute. In the administration and operation of this institute the Surgeon General shall select persons who show unusual aptitude in science. The Surgeon General, with approval of the Secretary of the Treasury, may make such rules and regulations for the government and administration of such institute as he deems advisable. There is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $10,000,000, or so much thereof as may be necessary, to carry out the provisions of this act.

SEC. 2. The Secretary of the Treasury is authorized to accept, unconditionally, on behalf of the United States, gifts by will or otherwise for study, investigation, and research in the fundamental problems of the diseases of man and matters pertaining thereto. Any such gift shall be held in trusts and shall be invested by the Secretary of the Treasury in securities of the United States, and the income thereof shall be administered by the Surgeon General for the purposes indicated in this act. The Surgeon General is authorized to established fellowships in the hygienic laboratory and the National Institute of Health, and utilize the proceeds thereof in aid of individual scientists who have demonstrated or give promise of marked proficiency in research and investigations relating to the diseases of man. Donations of $500,000 or over in aid of research will be acknowledged permanently by the establishment within the institute of suitable memorials to the donors.

SEC. 3. Individual scientists designated by the Surgeon General to receive fellowships may be appointed for duty in the hygienic laboratory and the National Institute of Health established by this act. During the period of such fellowship, these appointees shall hold appointments under regulations promulgated by the Secretary of the Treasury, and shall be subject to administrative regulations for the conduct of the Public Health Service. Scientists so selected may likewise

be designated for the prosecution of investigations in other localities and institutions in this and other countries during the term of their fellowships.

SEC. 4. The Secretary of the Treasury, upon the recommendation of the Surgeon General, is authorized (1) without regard to the civil service laws to appoint, and without regard to the classification act of 1923, fix the compensation of such professors, instructors, and experts; (2) in accordance with the civil service laws to appoint, and in accordance with the classification act of 1923, fix the compensation of such clerical and other assistants; and (3) to make such expenditures (including expenditures for personal services and rent at the seat of government, for books of reference, periodicals, and exhibits, and for printing and binding) as he deems necessary for the proper administration of such institution.

SEC. 5. The facilities of the institute shall from time to time be made available to bona fide health authorities of States, counties, or municipalities for purposes of instruction and investigation.

Senator RANSDELL. Gentlemen, this is a hearing on Senate bill 3391, to establish a National Institute of Health, to authorize increased appropriations for the hygienic laboratory, and to authorize the Government to accept donations for use in ascertaining the cause, prevention, and cure of disease affecting human beings, and for other purposes.

A subcommittee of the Senate Commerce Committee, composed of Senators Gould, Sackett, Nye, Copeland, and myself, of which I have the honor to be chairman, was appointed to hold hearings on the bill.

I will ask Dr. Charles H. Herty, who is the adviser of the Chemical Foundation of New York, to explain briefly the purposes of the bill, and introduce the next speaker.

Senator COPELAND. Doctor Herty is one of the most eminent physicians and scientists and hygienists and sanitarians in the United States, may I say, Mr. Chairman.

Senator RANSDELL. That is quite correct.

STATEMENT OF DR. CHARLES H. HERTY, NEW YORK CITY, ADVISER OF THE CHEMICAL FOUNDATION (INC.)

Senator RANSDELL. I do not want to limit you, Doctor Herty, but I think it would be best if you could confine your remarks to about 10 minutes, and then let Dr. Reid Hunt come next, and later on we will give you all the time you care to occupy. I understand Doctor Hunt has to hurry back to his post at Harvard.

Doctor HERTY. My name is Charles H. Herty, and I am adviser of the Chemical Foundation (Inc.).

Senator COPELAND. That hardly gives the background of a long lifetime of service to the public in the prevention of disease.

Doctor HERTY. Mr. Chairman and gentlemen of the committee, in these few minutes of introduction, I would like to call your attention to the fact that this bill, which has been referred to your committee, involves three distinct features, the first being the creation by statute of a national institute of health within the Public Health Service, and under the administrative direction and control of the Surgeon General, who is the head of that service. In other words, the bill calls for no new bureaus, no new commissions, but it utilizes existing governmental machinery. In that same connection it calls for an appropriation of $10,000,000 for the purpose of purchasing sites, erecting laboratories, equipping them and maintaining them and for carrying out the other purposes of the bill. That is the first general feature of the bill.

The second feature is a feature on which I have heard a great many very interested and enthusiastic comments. It was inspired, I think the chairman will bear me out, by the example set by James Smithson, who gave to this country a small bequest—at that time a large bequest—which resulted in the establishment of the Smithsonian Institution. As I understand the law, at present money can not be given to the United States for this most helpful of purposes except by special act of Congress. Section 2, authorizes the Public Health Service of the United States to accept gifts unconditionally on behalf of the United States, and so on, by will or otherwise, for study, investigation, and research in the fundamental problems of the diseases of man, and matters pertaining thereto, with a proviso that if gifts are in amounts of half a million dollars or more, the name of the donor shall be attached to the gift, just as in the case of Smithson.

There are many people to-day, I find, who feel that they have money they would like to give for purposes of this kind. They have confidence in the spending of it by the United States Government, and particularly by the Public Health Service, which has had such a fine record of usefulness.

Senator COPELAND. Would that provision be broad enough: "Research in the fundamental problems in the diseases of man and matters pertaining to health"? I suppose that would include curative measures, if any were devised.

Doctor HERTY. Oh, yes; that covers everything. The bill is drawn, as I read it, and very wisely drawn, I think, on very general lines, so that under the administration of the Surgeon General and his staff, wide latitude is given for all lines of development.

The third feature is one which provides for the creation of a very important group of fellowships, to be filled by distinguished young scientists, men who have had ample training in medicine and special branches of science, who will carry out in the Public Health Service the fundamental research referred to in the early part of the measure. You will notice then particularly a line there which appeals to me as being common sense, and wise. I refer to page 3, line 16, where it is provided:

Scientists so selected may likewise be designated for the prosecution of investigations in other localities—

That is, other than Washington, D. C.

and institutions in this and other countries during the term of their fellowships.

In other words, wherever a problem of sickness or disease can be worked on best, the United States will be in position to give its help in the solution of that problem.

Senator COPELAND. That is, if it is a tropical disease——

Doctor HERTY. It can be worked on right down in the Tropics.

Senator SACKETT. Are these fellows to receive salaries?

Doctor HERTY. Oh, yes; and they give their lives to this work.

Senator SACKETT. Is the number limited?

Doctor HERTY. There is no limit. It will be limited only by the amount of the appropriation.

Senator RANSDELL. That would depend on the amount of the appropriation, and the gifts from wealthy people who are interested largely in contributing, in addition to what Congress gives. We did not want to limit it, because sometimes very able men would not be

willing to give their lives unless they got good salaries. We thought we could trust that to the Public Health Service.

Doctor HERTY. Mr. Chairman, those in a general way are the three main features of this rather unique piece of legislation. Yet it is not unique, because it really involves practically no new principles at all, and no new machinery.

I would like, in the remaining few minutes, to insert in the record the testimony of a number of national organizations which have indorsed this measure. I do not know that you care to have them all read in detail.

Senator SACKETT. Before you get to that; I came in while you were discussing the first section, and I notice there is provision for an appropriation of $10,000,000. Is that to be used as a going fund or to be an endowment, the income only to be used?

Doctor HERTY. Under the terms of the bill, as I read it, it can be used outright for the purchase of a site, it can be used for the erection of buildings, for the equipment and maintenance of these laboratories, and for the payment of the salaries of these men who hold fellowships.

Senator SACKETT. It can be used in that way; but it is not definitely stated there what portion of it is to be used for the maintenance, and as to how long it is to be used, whether it is an appropriation simply for one year, or whether it is to go over a period of years.

Doctor HERTY. I think, Senator, that would be a question for the committee or for Congress to determine. There is an amount named in the bill, which will certainly give the work a good start.

Senator RANSDELL. I will state that all I had in mind was to give it a good start, feeling that if Congress ever started such an institution as this, money would be appropriated thereafter to carry it forward.

Senator COPELAND. I take this to be the case, too, if I may answer the question of the Senator from Kentucky: This is an authorization. We would then have to appear before the Committee on Appropriations, in due time, with a specific plan as to how this money is to be used.

Senator SACKETT. That is true, too, but what I had in mind was this, whether you had a definite scheme as to the value of the plant that you want to establish, and whether you had a definite scheme as to what would be the running expenses of the institution. I asked the other question in regard to the number of fellows you were going to have, in order to bring out in general terms what your idea was as to the scope of the work, how large it was to be, and what it would probably require in the way of annual appropriations? Can you give us an idea?

Doctor HERTY. I can not, Senator. Those details have really not been developed as yet. It will depend upon the question, first, whether Congress is disposed to develop a matter of this kind.

Senator SACKETT. Do you not feel that Congress would be more disposed to develop it if they had a rather concrete idea of what the plans were, rather than to state the matter in such a general way?

Senator COPELAND. I suggest that before the hearings close such details as Senator Sackett mentions be offered for the record. Now we can just consider the plan, get the general picture of the plan, and bring in the details later. I agree with the Senator fully that they would have to be worked out.

Senator RANSDELL. I would be glad to do that, but I will say again that this is something unique. Such a thing has never gone on anywhere in the world that I know of. We have a great Hygienic Laboratory, great in the sense of the wonders of the work it is doing, but small in the very small appropriations made for it. This bill contemplates that the Hygienic Laboratory shall do a great part of the work. You notice on page 3, paragraph 3, a reference to the Hygienic Laboratory. We will get the work started, and carry it forward as best we can. In paragraph 1, we provide for an authorization of $10,000,000 to get the work started.

I agree absolutely with Senator Sackett that we ought to know just where we are going before we start, but I do not know how anybody in the world can figure that out. I do know that the Agriculture Department started in a very small way. When I came to Congress, 29 years ago, it was not amounting to much, and I do know that last year we gave $10,000,000 to fight the corn borer. I do know that I am asking now $5,000,000 to fight the pink bollworm. I know that a few years ago we gave, without batting our eyes, $5,000,000 to fight cholera in hogs, and we gave $5,000,000 several years later to fight the foot-and-mouth disease in cattle. I take it that we can get this started in the small way we provide in this bill, and it will grow by leaps and bounds. But I do not believe we can tell, you Senator, definitely where it is going to lead. That is the thought I have, to get the matter started.

Doctor HERTY. I think a plan of this kind could be readily drafted, namely, an estimate of the cost of a site, a rough estimate, the cost of the building of a laboratory, and then a supplemental scheme with fellows through the various branches of science, because this contemplates fundamental research, in chemistry, physics, biology, pharmacology, all in cooperation, which would have to be an elastic scheme. It can be expanded indefinitely. The problems are so innumerable we can not get enough workers in the country to work on them. We will have to train them, and it can be made elastic, to go just so far as the Surgeon General and his staff feel it is wise to go, of course under the direction of Congress as to how much money it is willing to spend to support this research.

Mr. President, I have here a number of indorsements of this bill. I do not think it is necessary to take the time to read to the committee the wording of these unless you would like to hear them read.

Senator RANSDELL. I think if you will state the names of the associations, without reading them, that will suffice.

Senator COPELAND. Then they can be included in the record.

Senator RANSDELL. Yes; we want them included in the record.

Doctor HERTY. The first is an indorsement by American Chemical Society, which represents more than 15,000 chemists, in their national organization, who unqualifiedly indorse the bill.

I might say in this connection that some of these resolutions refer to a bill with a certain number, and some to other bills, because this matter has been through several changes in the last few years. But the members of these associations are in favor of one of the bills referred to. The bill has gone under two numbers in different Congresses, been combined with the so-called Parker bill, and split again. But all the bills include the features of the bill we are considering to-day.

I have here the resolution of the American Chemical Society, which represents, as I have said, the organized chemists of America.

(The resolution is as follows:)

RESOLUTION UNANIMOUSLY ADOPTED BY THE COUNCIL OF THE AMERICAN CHEMICAL SOCIETY, RICHMOND, VA., APRIL 11, 1927

Whereas the prevalence of sickness among our people, with attendant suffering and economic losses, points clearly to the need of a greater amount of fundamental research for the alleviation of this condition; and

Whereas all are subject to sickness, all should participate in providing for this necessary fundamental research: Therefore be it

Resolved, That the council of the American Chemical Society approves the principles embodied in the bill S. 5835 (reintroduced Dec. 9, 1927, as S. 871; number of present bill S. 3391), introduced in the Sixty-ninth Congress by Senator Ransdell, providing for a national institue of health and for needed administrative reforms in the United States Public Health Service, and urges its early and favorable consideration by the Seventieth Congress.

Doctor HERTY. I have here a resolution from the American Medical Association, which is the great national organization of the physicians of the country. I submit that for the record, too.

Senator COPELAND. Do they indorse it?

Doctor HERTY. Yes; at their meeting here last April, by the house of delegates. Shall I read it?

Senator COPELAND. I think it is wise to read that one.

Doctor HERTY. It is as follows:

[Extract from the proceedings of the Washington session, house of delegates, American Medical Association, Washington, D. C., May 18, 1927. Supplementary report of reference committee on legislation and public relations]

Dr. E. J. Goodwin, Missouri, read a supplementary report of the reference committee on legislation and public relations:

"The reference committee recommends that the house of delegates reaffirm its approval in principle of the Parker bill approved at the Dallas session, coordinating all public health activities of the Federal Government under the direction of the United States Public Health Service. We also recommend the approval of the Ransdell bill, which is identical with the Parker bill, excepting that the Ransdell bill appropriates $10,000,000 to establish and operate a national institute of health under the control of the Surgeon General of the Public Health Service."

The report as a whole was adopted on motion of Doctor Goodwin, seconded by Dr. A. T. McCormack, Kentucky.

That was adopted unanimously by the house of delegates of the American Medical Association, which is their legislative body.

Senator SACKETT. Do you know how much explanation of the bill there may have been before that time?

Doctor HERTY. I know that the Chemical Foundation was very deeply interested in this whole question, and we distributed much information, had reprinted a copy of a speech Senator Ransdell made on the floor, and sent it out with copies of the bill.

Senator COPELAND. If there is anybody more hard-boiled than a lot of coal men it is doctors, and they never would have indorsed this bill unless they had known its scope.

Senator SACKETT. A record of that meeting shows any discussion that took place, I suppose?

Doctor HERTY. The Journal of the American Medical Association has indorsed it, and urged the Medical Association to support it. This resolution was adopted at the annual meeting last April.

Here is a resolution from the American Public Health Association, which I also ask to have inserted in the record.

Senator RANSDELL. They also indorse the bill?

Doctor HERTY. Yes. These are all indorsements I am reading.

Senator COPELAND. That association is made up of the officers and officials of the health departments?

Doctor HERTY. In all the different States.

Senator COPELAND. In all the States of the Union, and also all physicians in welfare work, and these particularly interested in the control and prevention of disease.

Doctor HERTY. To my mind one of the striking things about it is the proof of how well the State health men are cooperating with our national health men in this movement to support and build up research in the national health department.

(The resolution is as follows:)

RESOLUTION PASSED AT THE FIFTY-SIXTH ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION HELD IN CINCINNATI, OHIO, OCTOBER 17–21, 1927

Recognizing the need for thoroughly coordinated effort on the part of all Government agencies concerned with questions of public health; and

Convinced that fundamental research is the necessary foundation for all progress in health problems: Therefore be it

Resolved, That the American Public Health Association hereby approves the principles of the Ransdell bill, introduced in the Senate of the Sixty-ninth Congress of the United States on March 2, 1927.

Senator COPELAND. You touched on a very important thing, a matter which will be raised in Congress. Some one will say, "Well, why do not the States do this? This is an invasion of the rights of the States." It is very significant, as you have said, that the Public Health Association, representing the various States, had this enthusiastic and unanimous indorsement of the Ransdell bill.

Doctor HERTY. The answer to that is very simple. When cancer hits, it does not consider State lines. When tuberculosis hits, it does not know north, east, south, or west. This bill provides for fundamental research on sicknesses characteristic of every State in the Nation. This bill has nothing to do with the immediate question of control of anything. This bill is simply one seeking provision for fundamental research which will put the best and the newest tools and newest discoveries into the hands of our physicians, and into the hands of our State public health authorities, so that they can do better work than they are able to do with the limited scientific knowledge at their command to-day.

Senator RANSDELL. I would like to state what happened in the South in 1905, after the last great outbreak of yellow fever. The Southern States had been opposed to the Government controlling quarantine, up to that time, but after that yellow-fever outbreak they had a big meeting in the city of Chattanooga and unanimously appealed to the Federal Government to take absolute control of quarantine at all of the ports of the land, saying they could not handle problems of health because, as the doctor says, diseases pay no attention to State lines. A yellow-fever patient would land in New Orleans and jump on a train and be over in Texas or over in Mobile, Ala., within a few hours. As a result of the action of those State authorities at that time, Congress passed a national quarantine

law, which has been effective in keeping out importations of disease. I think that helps to answer your question, Senator Copeland.

Senator COPELAND. Yes; and it makes the record better.

Doctor HERTY. I next have a set of resolutions from one of the oldest organized bodies in the country, the American Institute of the city of New York, which celebrated its centenary last month, an organization which in previous years has had a great deal to do with the development of many important matters of public welfare. I have their resolution here, which I submit for insertion in the record.

(The resolution is as follows:)

RESOLUTION ADOPTED JANUARY 18, 1928, BY THE AMERICAN INSTITUTE OF THE CITY OF NEW YORK

Whereas the American Institute of the City of New York, a membership corporation operating under an act of the Legislature of the State of New York in the interest of industry and human welfare, is cognizant of the importance of health to the Nation; and

Whereas the American institute appreciates the need for increased research into the diseases of man and the dissemination of authoritative information relating to said disease and the public health; and

Whereas the American institute recognizes that this research and information service is of a character to warrant and demand the attention of all people: Be it therefore

Resolved, That a certain bill relating to public health and providing for the establishment of a national institute of health and increased appropriations for the Hygienic Laboratory, introduced into the second session of the Sixty-ninth Congress by Senator Randsell, be, and hereby is, approved; and that the clerk of the American institute be, and hereby is, instructed to transmit a copy of this resolution to the Senators and Representatives of the State of New York.

Doctor HERTY. I had hoped we might have something from the American Pharmaceutical Association, but unfortunately their annual meeting does not come until August. But I had this telegram yesterday from the president of that association, Dr. C. W. Johnson, of Seattle, Wash.:

SEATTLE, WASH., *April 21, 1928.*

Dr. CHARLES HERTY,
The Chemical Foundation, 85 Beaver Street, New York, N. Y.:

Association not acted on Ransdell bill; intended to urge same in address at annual meeting in August. Am wiring Secretary Kelly, of Baltimore, to attend hearing and support measure.

C. W. JOHNSON.

So that it is simply a question of dates.

I received last night in the mail a letter which I am very happy to put into the record. At the meeting of the American Association for the Advancement of Science in Nashville last December the medical section of that association discussed this matter and very heartily approved this measure. They passed resolutions to that effect, and then, having done that, passed it up to the council of the whole association, because that association is an organization which represents all branches of scientific work.

Unfortunately, in the pressure of work at their council meeting, it was not possible to reach these resolutions, so I wired the secretary of the association last Friday and asked if he could let me have the views of the medical section, because it represented the views of the medical men of the American association, for incorporation in this record.

Last night, upon reaching Washington, I received this letter from the executive assistant to the secretary:

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE,
Washington, D. C., April 23, 1928.

Dr. CHAS. H. HERTY,
Adviser Chemical Foundation,
85 Beaver Street, New York, N. Y.

DEAR DOCTOR HERTY: With reference to your telegram of April 20, you will be interested in the following action taken by the executive committee at its meeting held in Washington on April 22:

"The executive committee of the American Association for the Advancement of Science, approving the action of the medical section of the association at Nashville, and representing the 16,000 members of the association, urges Congress to give special consideration to the desirability of providing means of maintaining human health in some such manner as is outlined in the Ransdell bill (S. 5835)."

Yours very sincerely,

SAM WOODLEY, *Executive Assistant.*

The number given in this communication is the old number, S. 5835, which includes all of the features of the bill now under discussion.

I think, gentlemen of the committee, that presents a pretty sound survey of the hopes and opinions and wishes of the great body of scientific men of America with reference to this matter, which proposes that our Government shall do more for fundamental scientific research on the problem of health.

I have taken over my 10 minutes, I am aware.

Senator RANSDELL. That is all right. It has been very instructive.

Doctor HERTY. Dr. Reid Hunt is here; and I hope to have the pleasure, if the committee will let me do it, of speaking a little later in the session.

Senator RANSDELL. We shall be very glad, indeed, to have you do so.

Doctor HERTY. There are several things I should like to talk to you about.

Senator RANSDELL. Will you introduce the next speaker?

Doctor HERTY. Gentlemen, I am very fortunate in being able to present to you Dr. Reid Hunt, of the Harvard Medical School, a former officer of the Public Health Service, and now the head of the department of pharmacology in the Harvard Medical School.

Senator Ransdell and I asked Doctor Hunt in advance if he would not tell us something about what other countries are doing in this line, so that we could get a little background of this picture before we get too far into the details of it, as to what is being done on this subject in other parts of the world, and, of course, anything else he wants to tell us about. Doctor Hunt is the leading pharmacologist of the United States, and I am sure he will be very glad to aid the committee in any way he can.

STATEMENT OF REID HUNT, OF THE DEPARTMENT OF PHARMACOLOGY, HARVARD UNIVERSITY MEDICAL SCHOOL

Doctor HUNT. Mr. Chairman, in a way it would be a little more pleasant to refer to the magnificent work which our Public Health Service has done, as well as other agencies of the United States; but I was asked especially to discuss the work in foreign countries. I might say, however, that what the present Government services have accomplished is an extraordinarily fine promise of what they are capable of doing with larger facilities. To look back, however, at the striking progress that has been made in medicine in the last 60 or 70

years, you will have to admit that the big advances, with a few outstanding exceptions, have been of foreign origin; and the roots of many of them have been in the German laboratories, supported by the German Government.

For example, as early as 1880 the Prussian Government established an institute for Robert Koch, and soon afterward it established other institutes at Frankfort (the Koch Institute was at Berlin) and Marbach; and then, later, the imperial government established magnificent institutes at Berlin; and it is from these institutes that much of the fundamental knowledge which is being used to combat disease has come.

The question of $10,000,000 was mentioned. It is perfectly safe to say that those German research institutes, founded from 20 to 40 years ago, could not possibly be duplicated and equipped in the United States for $10,000,000, or for a good deal more than that.

I should like just briefly to refer to some of the work which has come from these institutes.

Take the subject of tuberculosis, for example: The cause of the disease was discovered in one of these German institutes, improved methods of diagnosis, and improved methods of treatment; and to this day, of course, the American child and baby is protected against tuberculosis by the tuberculin test of cattle.

There is the same history with diphtheria. We probably hardly remember the anxiety which our parents felt about us when we were infants because of the dangers of diphtheria. The cause of diphtheria was discovered in these German institutes. The toxin was discovered, and the antitoxin. The French contributed somewhat to the introduction of antitoxin; but the diphtheria antitoxin and methods of testing it were perfected in these German institutes.

The same thing is true with regard to tetanus or lockjaw. We might say that the United States Public Health Service and all the world standardize and determine the potency, etc., of diphtheria and tetanus antitoxin by the methods worked out in these German institutes.

The same way with cholera. We protect the United States from cholera as the result of German discoveries.

Typhoid fever, also: The cause of the disease was discovered in Germany; and it was this work and the work of the English in South Africa which has enabled the United States to control typhoid in the Army as well as in the civilian population.

The causes of the other diseases—of course it is hard to combat a disease in general without knowing the cause—but the causes of many diseases, such as pneumonia, erysipelas, blood-poisoning, gonorrhea, etc., have practically all been determined in these German institutes.

It has not been very many years since syphilis was just as mysterious a disease as things like cancer and infantile paralysis are at present. Twenty years ago it seemed almost hopeless to find the cause of syphilis; and yet the German Government laboratories within a few years discovered the cause of syphilis, and discovered vastly improved methods of diagnosing it, and improved methods of treatment.

Take malaria, which has been such a big problem in the United States: There, again, we have relied entirely upon the fundamental discoveries of Europeans, and the work of the English in India, and

the Italians, to control malaria. Of course, then it was the control of malaria, and methods worked out in relation to the mosquito, etc., which formed the basis for the control of yellow fever.

Japan in 1892 established a national institute for such studies; and the Japanese discovered the cause of plague. We keep plague out of the United States largely as the result of this fundamental work in the Japanese Government institution.

The Japanese also discovered the cause of one of the most serious forms of dysentery.

Then other studies—the X ray, for example, of such immense importance in diagnosis and treatment—was purely a German discovery.

Radium, of course, was a French discovery.

When we come to study the methods which have been devised for relieving pain, there again they are practically all of foreign origin. The one outstanding exception, the one outstanding contribution the United States has made, was the introduction of ether as a surgical anesthetic in 1846—the first and the last great discovery in the United States in these lines. Ether itself was a drug of German discovery.

Up to about 60 or 70 years ago opium was almost the only really valuable drug available for the relief of pain. There were practically no drugs to relieve pain in such cases as headache, toothache, rheumatism, gout, etc. There were no local anesthetics—nothing to put in the eye, for example, to get a piece of steel out of the cornea, or things of that kind, and pieces of dust. There was no local anesthetic whatever.

In the last 60 or 70 years, practically every form of pain can be remedied. Remedies for practically every form of pain have been discovered; and here, again, most of them have come from German laboratories, either the university laboratories or the government-supported institutions. Of course all the German university laboratories are government laboratories.

One of the unfortunate situations in this field is the slowness of the application to health problems of the advances in chemistry and physics.

Take ether, for example: The method by which it is made at present was described fully in 1545, but it was 300 years before mankind learned to use it to produce anesthesia; and of course that idea of relief from pain during operations goes back to the time of Adam, at least. There was a lag of 300 years there.

The same was true of chloroform. Chloroform was discovered by the chemists, it was a well-known chemical, 30 years before its anesthetic properties were discovered.

But to come down to the most recent general anesthetic, ethylene, which I understand is used quite extensively in Providence Hospital here, and is used all over the United States quite extensively, it is replacing ether and chloroform to some extent; and acetylene is being used a great deal in Europe, especially in Germany. Many consider those two much more desirable anesthetics than ether and chloroform. They were both introduced in the last five or six years—ethylene by Canadians and also by Chicago men, and acetylene by the Germans.

These two drugs or substances have been known for over a hundred years, but nobody got around to testing them out to see if they would be of any value in the relief of pain, etc., in medicine. Ethylene was

used quite extensively during the war in the manufacture of mustard gas, one of the most effective of the poison gases used. Acetylene, of course, has been used in industries for a great many years, in the acetylene torch, and used for lighting houses, and in bicycle lamps; and yet here was this wonderful anesthetic drug, capable of producing fine anesthesia, which had never even been tested for its possible medicinal value.

The same thing is true of nearly all of the drugs which we rely upon every day for relief from pain.

Acetanilid is the basis of nearly all of the common headache remedies—that or derivatives of it. That was known, the chemists had known it, at least 50 years before it was found that it would relieve headaches. Take such symptoms as headache: A person now for 5 or 10 cents can go into any place in the world, almost, and get relief from headache which nobody could have bought at any price 75 or 100 years ago.

It is rather interesting to read the medical account of George Washington's last illness, to see how little could be done to give him any relief whatever, because the drugs had not been discovered.

Of course these instances could be multiplied almost indefinitely; but I will mention just one more striking illustration, and that is carbon tetrachloride. Chemists have known that for over 100 years. It got into use for cleaning clothes and for fire extinguishers, Pyrene, and so forth—but it is only seven or eight or five or six years ago that a man in the Bureau of Animal Industry here found that it was a very efficient remedy for worms in animals, especially dogs. Then it was found that it was a very efficient remedy in hookworm disease; and already the International Health Board has treated and cured and restored to useful lives 10,000,000 persons suffering from hookworm disease; and of course the Public Health Service and other people have treated millions more.

Here, according to conservative estimates, are fifteen or twenty million people restored from sickness to health and made useful citizens again as the result of these simple experiments here in Washington with an old drug; and it probably cost the Government only a few hundred or a few thousand dollars at most to make this discovery, of such tremendous importance.

Senator RANSDELL. Does the world owe that to Europeans, or to this country?

Doctor HUNT. The world owes that discovery to the United States Department of Agriculture, the Bureau of Animal Industry.

Senator RANSDELL. That is what I thought.

Doctor HUNT. The drug itself was discovered in Europe.

Never in the whole history of the world, I think, have the efforts to improve health conditions been so far behind the advance in other sciences. The applications to public health are certainly lagging, simply because there are no good places to study them as the should be studied. Every year thousands of new chemical compounds are discovered, and they are studied to see if they are useful as dyes or paints or in photography or in the rubber industry or varnishes or the automobile industry, etc.; but practically none of them are studied from the standpoint of their possible use in health, and we have these illustrations that I have mentioned. A few years ago nobody supposed—well, of course ethylene, this new anesthetic, was used to

ripen fruit, to hasten the ripening of oranges and give them a yellow color, and, as I say, it was used for making poison gas during the war; but a person would hardly look to those sources for an anesthetic for surgical operations. The same way with acetylene: A person would hardly look in a bicycle lamp for a drug which would be a valuable anesthetic, and yet there it was acetylene.

Salvarsan, which has greatly improved the methods of treating syphilis, was only a slight modification of drugs which were made in 1878.

Very few efforts have been made to make use of the wonderful new discoveries in physics, the kind of work which has led to wireless telegraphy, etc., in the treatment of disease.

There are clear indications that some of these electromagnetic waves may be of a great deal of value. For example, the cancer of mice can be made to disappear with a few minutes' application of some of these waves. So far as I know, there is just one person in the world who is working on this subject, and he is an officer of the United States Public Health Service who is working at Harvard at present, because there he has the closest cooperation of physicists and pathologists, things which the Public Health Service does not have under its present organization; so he is working at Harvard, but he is interrupted every little while by being sent off for quarantine work or immigration work. But it is the most promising field of work, and so far as I know there is just this one man in the whole world engaged in it, and yet cancer, of course, is one of the big problems.

Of course there are plenty of unsolved problems. In fact, the diseases which are causing sickness and death at present are just exactly those that we know least about. It has been the history all along that when we learn more about the causes of disease, then methods of treatment and cure develop.

Cancer, of course, is an absolute mystery. It is no more mysterious, however, than syphilis and yellow fever and malaria and all those things were a few years ago, but still it is a complete mystery. Cancer and different forms of pneumonia and diseases of the kidneys and diseases of hardened blood vessels are probably the four conditions which cause the most deaths at present, and they are conditions about which the least is known.

Of course, we still are somewhat fatalistic. We rather assume that so many people necessarily must die of cancer, or must necessarily have kidney disease, or must have diseases of the heart and arteries, etc.; but it is not so long, of course, since we assumed that children had to have diphtheria, and had to have scarlet fever, and had to have smallpox, and so forth.

There is just one other thing which I should like to mention—the provision authorizing the acceptance of gifts for such research. That seems to me to be a very valuable feature of this work.

As I understand the situation, similar provisions are in force as regards the National Museum, the National Zoological Park, and the Smithsonian Institution. I understand that Mr. Frear gave $5,000,000 for an art gallery. It is my understanding that the Congressional Library, since it was authorized to accept gifts, has received in the last two years something like $2,000,000 of such gifts.

Senator GOULD. You do not know of any of those philanthropists that are waiting now for a law to pass to allow them to put money into this institution, do you?

Doctor HUNT. No, except that I do not know that men with a good deal of money come to some of the universities——

Senator GOULD. I think Senator Sackett mentioned something here that ought to be considered. Have you any idea how much it would cost to build a building and create a laboratory such as would be efficient for a matter of this kind? Have you ever made any estimate or known of anyone making any estimate on the equipment?

Doctor HUNT. No. I have always thought that that would be a matter of growth, as Doctor Herty said.

Senator GOULD. But you have got to have a nucleus to start with. This calls for $10,000,000. It does not say whether it might be all appropriated for buildings or for equipment or for salaries, or what it should be for. It might go into the hundreds of thousands, or it might take the whole $10,000,000 to build and equip a building here, and there would be nothing left for salaries, etc. You do not want the organization there, with no appropriation to employ someone to carry out the purposes of the bill.

Senator COPELAND. I think, Senator, it is understood that we are going to go into that at a later time, after we have had time to consider those various details.

Senator GOULD. Should there not be an amendment to this bill so as to clarify that?

Senator COPELAND. Yes; that can be done.

Senator RANSDELL. I should be very glad to go into that as fully as we can.

Senator GOULD. I did not know but that these people who have had this matter in mind for some time had some idea of what it would cost to establish and equip the institution.

Senator COPELAND. Doctor Hunt has been so busy finding out how to cure people of disease that he has not given much thought to the construction of buildings, I venture to say.

Doctor HUNT. No. Of course I do not understand congressional appropriations——

Senator COPELAND. You are not any different from Members of the Senate in that respect. [Laughter.]

Doctor HUNT (continuing). But I was under the impression that the appropriations were adjusted to the needs of the different departments; that when they needed a few more men in the Public Health Service, Congress appropriated for a few more.

Senator SACKETT. They are more apt to be adjusted to the needs of the Treasury.

Doctor HUNT. As to these outside gifts, of course nobody can tell, but I do know that there are men with not enough money to found a Rockefeller Institute, for example, who are giving a great deal of money to universities. Some people think that too much of the money that goes to the universities is diverted to the teaching of medical students.

Senator GOULD. When I asked that question I did not know but that you might know of some very rich person who wanted to give some money to this purpose.

Doctor HUNT. No, I do not; but I think they will appear, just as Mr. Freer appeared here for the Art Gallery, and others contributed to the Congressional Library.

Senator COPELAND. I should like to answer that question, Senator. I know a man who has persistently refused to give a large sum of money for research in relation to a certain phase of disease because he felt that there was no institution in existence that was competent to administer the trust; and that is the great appeal in this to me.

Senator GOULD. I am very strongly for this bill; I want that understood to start with; but I should like to see it built up and supported in a business way.

Senator COPELAND. If we do it in a business way, and put it on a firm governmental foundation, we are going to encourage those gifts. There is not any question about that.

Senator GOULD. I did not know but that you or somebody might have in mind some one who was ready, when they had the right, to put in the money and make a contribution. It would make quite a difference whether you created an institution here at this time and spent all the money for buildings and equipment, etc., and had nothing left to operate with.

Senator COPELAND. I think it stands to reason that there is not any such thought as that involved in the bill, because the very broad statement of the first section indicates that this is a place which will be devoted to scientific research, and of course without the money it can not be had. I assume, as Doctor Hunt has stated, that we are going to start in a modest way; that there will be such a laboratory as the United States Public Health Service might deem important to begin this work. Then, as these gifts came in, as specific problems were turned over to the laboratory for study, such additional facilities would be provided as the funds would justify.

Doctor HUNT. That certainly has been the experience of the foreign institutes, that private donors have come.

For example, the German Government established the Ehrlich Institute at Frankfort. Within a year after it was started, Frau Speyer, the widow of the banker, made a large endowment; and it was in the George Speyer house—it was called the George Speyer House—that salvarsan was discovered. The gift there came immediately. Just a year or two ago, or two years ago—well, I am not quite sure of the time—but quite recently England established a national institute of health somewhat analogous to the one proposed in this bill, and copied somewhat after the Hygienic Laboratory; and I notice already that the British Empire Cancer Fund has turned over a large sum to this British institute, and the Miners' Welfare Fund has turned over a large sum to study the diseases of miners, and some dental board has done the same thing.

I think it is almost certain that gifts would come. I can speak as an outsider. The Hygienic Laboratory here has the reputation of being an extraordinarily successful and useful institution; and I know that it is the feeling around many universities, etc., that money goes much further in the Hygienic Laboratory than almost any other place in the country when it comes to research in these subjects.

Senator RANSDELL. Doctor, we are very much obliged. Would any member of the committee like to ask Doctor Hunt any questions?

Senator COPELAND. I should like to ask him a million, but we have not time this morning.

(Thereupon, at 12 o'clock meridian, a recess was taken until 2 o'clock p. m. of the same day.)

AFTERNOON SESSION

The subcommittee met, pursuant to the taking of the adjournment, at 2 o'clock p. m., Senator Joseph E. Ransdell (chairman) presiding.

Senator RANSDELL. I expect we had better come to order. I should like to say to those who were not here this morning that the pictures which are about to be shown were very kindly loaned to the Committee on Commerce by the Rockefeller Institute through the kindness of Doctors Flexner and Carroll, hoping that these pictures might assist us in passing the legislation we have under consideration for the establishment of a national institute of health. These gentlemen had heard about our efforts, and on my very urgent request, backed by Doctor Herty, they consented to lend the pictures, and Doctor Ebeling will explain them. Now, Doctor, you can say something, I suppose, in explanation of the pictures.

STATEMENT OF DR. A. H. EBELING, OF THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK CITY

Doctor EBELING. Yes; I can do that, and I should like to say something beforehand as to the purpose of the work.

Senator RANSDELL. We would be delighted to have you, before we turn the lights off.

Doctor EBELING. The body is composed of a vast number of cells, organized in such a way as to form tissues and organs. The individual cell may be considered as a part of a very complex organization, subjected to certain restrictions which do not allow it to manifest all its possible activity. Most of its potentialities remain latent in normal life. The life of a cell, however, is not necessarily bound to that of the organization.

If a chick embryo is removed from its shell, sliced into a fine pulp, and a thin layer of the pulp is cultivated in a suitable medium, the finely minced tissues, which were the component parts of the animal, do not die, although they are no longer an organized whole. The animal has ceased to be an individual, but it continues to live as a disorganized community. The life of the body, therefore, as an individual appears to be the expression of the activity proper of the living inividual cells as a whole. Each cell type is possessed of specific properties which determine the character of its association with other cells. A complete knowledge of the laws of cell association would lead directly to the understanding of the mechanism of vital processes within the body.

As Dr. Alexis Carrel has said:

> There is no possibility of ascertaining these laws by merely studying the living animal, because the phenomena which take place within the body are of a very high order of complexity. The problem has to be reduced to simpler terms. In order that the properties of a given cell type may be discovered, the organism must be taken in its component parts, without their life being interrupted, and each part studied separately. These tissues living outside of the body under

given physicochemical conditions will necesarily show their manifested and hidden characteristics. These properties are the basis of cell sociology.

Twenty-one years ago (1907) Professor Harrison succeeded in keeping fragments of tissue in a condition of survival outside of the organism and observed the growth in a drop of lymph of the nerve filaments of a frog embryo. But the tissues could not obtain their nourishment from the lymph, they degenerated and died in a short time. Doctor Carrel foresaw in this method an important way to make a fundamental study of tissue cells under various experimental conditions. To-day elaborate techniques give us the possibility of isolating pure strains of cells, preventing their death from their waste products, feeding them with special substances that each type demands and keeping them free from contamination by bacteria. It has taken more than 13 years of work to develop the delicate procedures by which the main cell types are made to live in a pure state outside of the body. Through these new techniques it has become possible to ascertain the specific properties, in pure cultures of connective tissue cells, epithelial cells and certain wandering cells known as amorbocytes. This new knowledge has aided in explaining many obscure phenomena. It has revealed to us the enormous potentialities of certain tissue cells, which become immortal when they live outside of the body under proper conditions.

I might say that we have now at the institute a strain of cells which was isolated in 1912 from a fragment of chick embryo, and it has been cultivated since that time, has been growing continually, because it has been treated in the proper way.

These methods have shown that the plasma of the blood is endowed with the important function of maintaining the tissues under restraint and of preventing undue cell multiplication. As an animal grows older, the power of its plasma to restrain growth increases, and this change in the properties of the plasma can be used to measure the age of the animal. In other words, the younger the animal the longer the life of the particular type of cell. The older it becomes, the more restricted is the growth.

However, it contains within itself the substances which directly or indirectly can determine cell multiplication and the regeneration of a tissue or the growth of cancer. Any protein, when divided into smaller molecules by digestive ferments, may determine cell multiplication. But these substances do not act for an extended period of time because they split the ammo acids into smaller fragments which are inactive. Some of the cells may cat as nurses for other cells. The leucocytes, which Metchnikoff has demonstrated to be the defenders of the organism against bacteria, are voracious cells and feed upon blood proteins and various substances that the other cells can not digest. Then, they manufacture products which can be used as food by fibroblasts and epithelial cells.

Many other problems have been investigated with the help of cells living outside of the body. Within the last two years the study of pure cultures of tumor cells has given us important information on the characteristics of cancer cells.

The ultimate results of a study of the life of tissues outside of the body will be of practical interest. The prevention of infectious diseases, which often cause death or a permanent deterioration of the body, has brought about an increase, not only in the quantity

but also in the quality of human beings. But still greater progress can be accomplished.

The cause of such diseases as nephritis, arteriosclerosis, cancer, insanity, etc., must be discovered. A steadier nervous system and greater intellectual and moral qualities should be given to the race. This can not be brought about without great advances in the knowledge of the fundamental properties of the cells. The progress of medicine is bound to the development of new methods for the study of living matter.

Now it is my purpose to show a film in which we have made use of the motion picture to aid us in the study of our problems. This [indicating] is a pulsating fragment or embryo heart. It is interesting because it shows the heart pulsating. This is a culture which has been placed in a suitable medium, and is functioning just as it did inside the small embryo. This has reference to strain of cells of which I spoke, which we have been keeping under cultivation since 1912. We use these cells just as a chemical reagent to study what a normal cell requires for its growth and at the same time also the malignant or cancer cell.

Here are the fiber cells which are growing out into the medium. The darker portions of the cell are the organs to be brought out more clearly because we have to add a dye to the neutral medium in order to bring out more contrast. These are some of the earlier pictures.

Now what you see going on before you is a process which in the incubator under the microscope covers a period of 24 hours and you are seeing it in 15 or 20 seconds. Of course, it is quite difficult to maintain focus, because the cells are growing out in different planes. Part of this picture, therefore, is obscured.

This [indicating] is a magnification showing the structure inside the nucleus of the cell, and the active parts of the cell itself.

Here are the nucleii of these two cells. The body wall and the internal organs of the cell. The cell is quite as complex in itself as is the more finely organized body which is composed of families of cells.

The point is here, that we are now studying the problems of obtaining these cells in pure cultures, so that we can study them and find out what they can do when growing in a pure state. When we have the normal cell, we can compare it with the malignant cell, the cancer cell.

This [indicating] is a dark field. These cells are illuminated indirectly as they are being photographed through the microscope, and you see what goes on inside the nucleus and the cell as well.

Here they are more or less conglomerated, and give an obscure picture.

Doctor HERTY. What is the magnification of that, Doctor?

Doctor EBELING. I should say that is about 15,000 times as you see it on the screen. Later on I will show higher magnifications which will show us a great deal more.

Here [indicating] we have been stepping up the magnification more or less. As soon as we do that we develop a new technique and a new field is opened up. Of course, moving pictures were made of cells many years ago, but no one has gone quite as far as this before. We run these films over and over again.

This [indicating] is quite a high magnification, as you will see. This is, roughly, about 25,000 or 30,000 times the size of the cell.

You see the nucleus quite sharply defined, and as soon as we increase the magnification, more is shown. Under low power they appear smooth, but as we continue the magnification we find a great deal of activity going on. The cell is changing in form continually, going out into the medium to meet conditions occurring in this region of the cell.

This [indicating] is a quite high magnification showing the structures inside the cell. Here is the nucelus and here are the structures known as the mitochondria, small snake-like bodies which are found in practically every sell. We do not know positively what their function is. Of course this is a highly magnified cell. You see detailed the outline of the nucleus. These pictures were made this last winter, so that they are quite recent. Of course we must realize that the action that you see is speeded up. We take these high magnifications and make exposures, and they are speeded up 40 to 60 times. They convey the idea of the great amount of action that is going on as these cells grow and multiply.

These [indicating] are malignant cells and cancer cells, highly magnified. Notice that these curious structures are continually moving about, changing their place in the cell wall.

Here [indicating] we have a very startling condition, a dividing cell. There are certain structures which arrange themselves before cell division takes place.

We study our films by running them over and over again, studying certain features of the film each time. There are too many conditions to note at one time.

I do not think I am exaggerating if I say that this is the first time that these films have been made to such a high magnification and we have been able to see so many details.

Here [indicating] are certain cells of the blood, and there are number of different and interesting cells in the blood, and we attempted to photograph those here in order to show the action of the cell and its motion. It shows some of the white cells of the blood. Of course these cells are out of focus, and therefore they appear like small illuminated spheres. You will notice that this cell rounds up more or less, then narrows, and then pulls apart. Now a very interesting thing will happen. This cell is going to be taken up by another cell, here it comes, and it consumes it, cannibalistic. These are certain types of cells from the blood, and here we show simply the motion.

We are interested here [indicating] in the configuration of the cell. What we see here is that the membrane is like a very fine veil which is continually undulating, and it is very clearly brought out by the dark field illumination. Now of course our operations under the microscope have extended for a long period of time.

Note here [indicating] the enlargement of this particular type of cell, which consumes the smaller cells. Those, as I said before, are the white cells, which have an important function. They can manufacture from the substances in the blood other substances which these other cells which we call the fixed type of cells can vitalize or live upon. This cell is increasing in size. It has taken up some of the smaller cells. These cells can act as scavengers of the blood.

Here [indicating] is the same type of cell. It is probably on the plane of the glass, stuck to it.

This is the end of the first roll.

Now while we are waiting, if there is anybody that would like to ask questions about what has gone before, I will be glad to try to answer them.

Senator RANSDELL. How do you apply that to the diseases of human beings, Doctor?

Doctor EBELING. Our intention is to study the available material, and the available material at the present time is diseases of animals. For example, we apply these by obtaining normal cells and cells which produce cancer, and cultivate them outside the body under known conditions at the same time, and therefore we can notice the effect. I think I can bring that out very fully in the last film if there is sufficient time to show it. It is a very highly specialized film, in which I can show more or less the conditions or the action, or at least the tissues of the normal cell and of the malignant cell. In other words, as we study these cells, the body is such a complete organism that it is exceedingly difficult to arrange conditions so that we are sure that we are not introducing too many variables. That is the satisfaction of this method. It is true that many of these are observed in the microscope, but they are not brought together as we bring them together here.

Senator RANSDELL. Does anyone wish to ask the doctor questions?

Doctor EBELING. It just occurred to me that it might be well to mention this interesting fact. Of course, the direct practical application of some of these things is more or less remote, but in this particular instance I am referring to the cultivation of vaccine virus for vaccination against smallpox. It was produced in calves, and we conducted some experiments, and we found that it was possible to cultivate the vaccine virus in a flask by the use of a common medium and tissue obtained from the chick embryo, and that after a period of about 12 days we had a sufficient amount of vaccine that could be used to inoculate 5,000 or 10,000 people. In other words, it is a huge step forward. The way has been opened up to the direct practical application of this method of tissue culture, which avoids the necessity of continued vaccination of animals to keep up the supply of vaccine virus. That is just a side issue to this method of tissue culture. That has been under way for the last 12 years. Doctor Carrell saw this was a method that would allow us to study individual cell types and then bring them together.

This next film shows the same operation and we are following it through a longer period of time. Of course, there are various terms that we use for the different portions of the cell. These are pseudopods or false legs. This is protoplasm, and as the cell moves it extends a portion of the body. This is not really a leg, but may be termed a pseudopod. This large cell has taken up the smaller one and is drawing it into itself and adjusting it. Meanwhile, of course, these cells are continuing to grow larger and finally they form what we call giant cells. This picture shows the results after 130 hours. There are some instances where this cell has taken up some of the smaller cells and is devouring them. These wave-like appearances are the folds in the membrane. In other words, the outline of the cell extends beyond this portion, but as it is exceedingly thin we can only notice it when it is folded. It looks like the legs of a spider.

Here again we have the same cell after a longer period of time of cultivation. Of course these operations are kept at the proper

temperature. We have an apparatus which allows us to do that. The microscope is first enclosed in an incubator. We have a source of light which is shown through the microscope. The apparatus is run for a considerable length of time. Of course there are many technical difficulties involved. Light is injurious. There is too much heat. All those things have to be taken care of.

Here [indicating] is the same type of cell. We see this also in certain types of cancer. This type of cell in the chicken, which is malignant, produces enormous growths.

The next picture shows the cell after 192 hours, eight days. We must bear in mind in these particular experiments we have not changed the operation, that is we have not added any fresh medium or done any washing, and these cells have become filled up with food and other waste products which accumulate, and unless something is done these cells will die. In these operations we have no circulation. It is necessary for us to change the foodstuff a bit every certain period of time, every 48 or 72 hours, or sometimes even every 24 hours. But we have developed our technique to such an extent that this is quite an easy matter.

Here [indicating] we have a dead cell, and this is on its last legs, so to speak. There is a rule in a culture that when a cell dries up it becomes round.

Now here [indicating] we have a pure strain of cells from rat sarcoma. As I told you, we are working with malignant growths in the lower animals, and this is a very pretty picture. In this you see many, many cell divisions. If you look around you can see many dividing cells.

Senator Ransdell. Does this illustrate the growth of the cancer?

Doctor Ebeling. Yes; the growth of cancerous tissue outside the body. Of course, I must add that they look very much like the normal cells of the same type, but they are able to do certain things which the normal cell is not able to do. This particular type of cell has the property of producing acid and also utilizing for growth certain substances which the normal cell can not utilize. That is one of the things which I wish to bring out, that by this method we can distinguish certain properties of these cells as compared to normal ones.

This [indicating] is a different film again showing the growth of these cancer cells, using the term "cancer cells" as the general term for malignant growths.

Here [indicating] is a dividing cell. This will pass over into this direction [indicating] and form a tissue. We have developed our methods to such an extent that we can measure what is going on. In other words, if we feed these cells certain substances, by means of projecting the image of the new growth, we can trace the growth and actually measure how much it increases, and can make comparison of the amount of growth, whether the substance is stimulating the growth, promoting it, or whether it is toxic and poisonous.

These are rather interesting. They are normal cells, slender nerve fibers. This is, I think, the first time this sort of work has been done, making pictures of those terminal ends of the spinal ganglia. These are the structures found alongside the spinal column. This work is extremely difficult because there is very little contrast with which to take the picture, and we have to concentrate on a small part of the process which is entirely out of the field. There is a lot of action

going on here. This is only a portion of the cell. The cell body is away off outside the field. You can not see what is going on, but there are small nodules forming and they seem to run back and forth. These changes are going on continually.

This method also allows us, after we have obtained pure cultures of a common type of cell, to bring these purest types together and then see what they do. For example, this is a mixed culture in which you have the ganglion cells in this region. This is the process which grows out. Here are some of the active cells which are growing out, and in this region [indicating] you will see that one of these cells disintegrates and breaks up into these particles, and another cell comes along and takes in a portion of this cell here. That is going on continually.

Here [indicating] we have a combination of two types of cells, and here we have a large outgrowth, an enormous number of these processes which grow from cells which are out of the field and they almost form a tissue.

These [indicating] are very minute structures. What you see going on before you in this short time covers a period of about 24 hours. There are an enormous number of these processes, many of them out of focus, in this region, because they are growing in different planes. This is the end of the second roll.

Senator RANSDELL. Doctor, we thank you very much. We will now hear from Doctor Johnson.

Doctor HERTY. Mr. Chairman, we have some little conception now of what a cell looks like, and I want to introduce to you Prof. Treat B. Johnson, Professor of Organic Chemistry of Yale University, who is doing some work in a cooperative way on the problem of tuberculosis. Every bacteriologist in the country tells me that the basis of bacteriology is chemistry, but as yet this problem has not been attacked except through this initial work that Doctor Johnson is doing on tuberculosis.

STATEMENT OF DR. TREAT B. JOHNSON, PROFESSOR OF ORGANIC CHEMISTRY, YALE UNIVERSITY

Doctor JOHNSON. Mr. Chairman and members of your committee, chemists are accused of not being able to present their language to the layman, and I think they are justly criticized for that weakness. So in telling you my story this afternoon I am going to keep as far away as I can from technical language and try to speak in ordinary common language that an ordinary layman can follow.

Now, before commencing my story, I would like to make reference to two or three statements that have been made since this conference started. I would like to refer to some remarks that were made by Prof. Reid Hunt of Harvard. He commented upon the accomplishments of the Germans, of the Italians, the English and the French. Now there is a group of men in this country, Senator, who are interested in science, that are anxious to see this country give them a chance, give some of the American fellows, the young American scientists, a chance to demonstrate their ability, and what we are trying to do is to stimulate an interest in inaugurating some researches whereby we can have an opportunity to do some of the things in which we are interested.

Now, there is nothing that can so help us, and can exercise such influence and such pressure and be of such controlling influence in aiding the things that we would like to do as governmental support, and we believe that with their coordination and their help and assistance we can accomplish a great deal more than we have ever undertaken before.

Another point that I would like to make clear also is that we are developing in this country at the present time a new science. The science we speak of is biochemistry. The American people at the present time are interested in biochemistry and are to-day taking hold in that particular development. We are only just beginning, but it is a well known fact that we have made greater advances in the field of biochemistry than in any other branch of chemistry that we practice.

Senator RANSDELL. Will you please tell us just what biochemistry is?

Doctor JOHNSON. The application of chemistry to biological problems, to answer you in general terms.

In my contact with chemistry, which has covered a period of 30 years, I have never had anything that has been so interesting to me, that has brought me into so close contact with problems of ordinary life, as this work that we have been doing on tuberculosis.

I would like to tell you somewhat of this cooperative work which I think will be of interest and enlightenment to you men. In the first place, I was approached to undertake this work by the hygienic laboratory of this city. They came to me and laid a proposition before me to institute, if I could, some attack on the tuberculosis problem by applying the principles of chemistry, and the first thing that I was told was that the fund that would be provided to support this work would be provided by the National Tuberculosis Association. When I was approached on that subject, I immediately brought up this query, "What do you expect a chemist to do with a subject like tuberculosis?" "What are you going to do? How are you going to attack the problem?" They replied to me, "We are going to leave that to you. We would like to have you tell us how to attack the problem."

Now, when I began to study the situation, I found that nothing could be done, no attack could be made on the problem, except through the application of the principle of cooperation. No single man to-day can cover any one single field of science individually and make progress. He must work in cooperation with other people, and the first thing that I had to do was to state the problem and the means of cooperation whereby I could draw on not only the services of the chemists but the services of the bacteriologists, of the pathologists, and the clinicians; and we had to organize, for example, a group of workers whereby we could have all of these lines working in unison and devoted to the general problem.

Now, a chemist has to have, in working, a large amount of material at his hand. Madam Curie would never have discovered radium except through cooperation in working up an enormous amount of raw material so that it would be available. The gas helium would never have been available to the Government or that service that makes use of it except through cooperation.

Consequently, in working on the tuberculosis problem, the first thing was to get hold of the cell and get it in large quantities to work with. Doctor Carrell's pictures reveal to you the structure of the cell. You can see the movements that take place, but the chemists ask, "What are the substances in this cell that are doing the trick? What is working in the cell that gives it this life, these wonderful properties of going through all these motions? What is going on in the cell?" It meant that the first problem that was submitted to us was one of analysis. We had to assay that cell, to use a metallurgical term. We had to break them down, to split them up into their component constituents, and to determine how they organize to produce the structure. We had to put our fingers on something, to take something out of that cell and study it. Now, that meant the production of material. Ordinarily when you speak of bacteria, a bacteriologist holds before you a tube with a plate, and you look at it through a microscope, and you see organisms, and you focus them and see the structure of the cell. It is in a very small quantity. The chemist could do nothing with that amount of material. The first thing we had to do was to inaugurate a cooperative scheme whereby we could get tuberculosis cells in large quantities to work with, larger quantities than were ever produced before.

In order to do that we went to the American manufacturers, and there are two manufacturers that have responded loyally to our request, and those are the Parke, Davis & Co. of Detroit and the Mulford Co. They have come to our support and they have made possible the chemical work that we have undertaken, and I can not say too much for what those companies are doing in the way of cooperation. For example, in order to produce the organism that we were to work with we had to have two or three or four pounds of desiccated tubercular cells.

Senator RANSDELL. How do you get those cells?

Doctor JOHNSON. Those cells are all grown by the manufacturer in incubators on a specific embryo. We know the food they get and control all the conditions in the incubator. We have as many as 2,500 bottles all growing under the same conditions of temperature and humidity. One bottle will produce two grams of pure culture. Two times 2,500 bottles is 5 kilos, and at the end of 4 weeks you have that large amount of material to work with. It is by operating on that scale, getting that support, that cooperation, that has enabled us to take the cell and analyze it and find out what it is composed of.

Now, I could go into a large amount of technical terms to tell you what is in that cell. I could tell you, Senator, of a great many substances that have never been discovered before. It would lead into technical language which would not mean much to you who are not familiar with chemistry problems. If we wish to classify them, we have sugar, phosphoric acid, proteid materials, etc., which are typical of the type of things we find. Our problem is to find out what is there and then to interpret their chemical phenomena.

The man who has been the most valuable, especially in my laboratory, in the last six months, is a graduate of Tulane University, educated in Louisiana. We have made observations which are very fundamental. In cooperation with us in this work we are associated with the Rockefeller Institute. Some of the best pathological work

that is being done in the field of tuberculosis is being done in coordination with our researches with Doctor Sabin and Doctor Dunn.

It is possible to-day to properly coordinate a tubercular cell and extract a perfectly definite known structure of known composition which can be injected into a tubercular-free animal and stimulate the tubercular infection. We believe from what we have found that there is a structure organism which produces a specific poison which can be spread through the blood and cause the disease. Our ambition has been to isolate that toxin. If we can do that and trace the cause of the disease to some unit of that cell, we think we have been well repaid for our efforts.

Now, just a word as to how this is supported. Personally I am sacrificing practically all of my time as a full professor of Yale University to that kind of work. The university has given me that privilege and is paying my salary to carry out this work. The salaries of my assistants are being borne by the National Tuberculosis Association. All the laboratory facilities to promote this work are being given by my college gratuitously in order to lend their support to this enterprise.

Senator RANSDELL. Yale University?

Doctor JOHNSON. Yale University, and I say that because it is with a spirit of true cooperation and interest as an educational institution that they have allowed me to go into this thing whole-heartedly as I have done.

Now, here is a very fundamental point that I would like to bring out. You have got in this country 400 active colleges and universities. They are the training ground of all of your coming scientists, your younger men that we are to call upon in the future for recruits. The Government is taking our men as fast as they can find them for all types of scientific work. Is it not true that the closer cooperation we can create between our national center and this broad group of educational institutions—is not our Government going to reap a benefit from that cooperation whereby we can coordinate these various problems and various institutions and centralize these activities in a place like this? I do not think there is any argument when you look into the situation as to what can be done, and I do not know of any better source of final moral support in an enterprise like this than the National Government.

Senator RANSDELL You approve the general ideas of this bill, Doctor?

Doctor JOHNSON. I sincerely do.

Now not only are we concerned in simply the question of the health of the public, the health of our people, but there is another factor that we must consider in this enterprise. You must remember that the stock raisers of the west are very much concerned, for example, in this activity of the study of bacteria. We are not dealing with the tuberculosis germ only as it affects the human, but we have bovine tubercular bacillus and the avian, which affects the fowl. In other words, there is an economic factor to be considered here that is in a sense almost as broad and signficiant as in the factor that we are trying to emphasize, as applying particularly to the public health problem.

Senator FLETCHER. Are they the same cells, or different?

Doctor JOHNSON. The bovine cells are the ones that appear in cattle. They are different. At the present time we are expending our time, from an economic point of view, growing the avian, growing the bovine, and the human, the three different types of this bacillus are being grown, and a very systematic piece of work is being applied whereby the construction of each one of these cells is being compared. We believe that if this is followed sufficiently far we will be able to detect chemical differences between those bacterial organisms.

Senator SACKETT. Does it go into vegetable life?

Doctor JOHNSON. I do not know.

Senator RANSDELL. You named three. What was the third?

Doctor JOHNSON. Avian, which applies to fowls. It is the organism which develops in the fowl.

Now, in connection with this work, we have gone so far that we believe that we ought to extend our program to other types of bacilli. We wish to take up bacilli that are associated with tuberculosis. We are interested in the timothy bacillus, which is the cause of hay fever infection. We have different ones under consideration, which we are going to incorporate into our story.

Now, at the present time we have operating in our laboratory in New Haven five coworkers under my direction who are devoting all of their time to this particular work. Our budget, which is being applied to tuberculosis in the university, is about $15,000 per year.

Senator RANSDELL. That does not include the salaries of the different ones?

Doctor JOHNSON. No. Let me give you some personal instances to show you the contacts that come up in this work. I had a very keen boy who came to me for graduate work four years ago from the State of Oregon. He was a Leland Stanford graduate. He had his M. S. degree in chemical engineering. He wanted to go to work on bacteria. He was one of the cleverest boys I was ever brought in contact with. Within a year he had an attack of pleurisy and tuberculosis developed. We sent him to the Keeler farm and six months ago the boy died in Oregon, an only son, and the most pathetic letter that I ever read in my life I received from his mother telling me of his death. There was a boy who had carried that disease for five or six years, and it was not revealed until the pleurisy weakened his lungs that the disease developed.

I had another boy who came to work for his doctor's degree. He is now in the Keeler farm sanitarium, and that boy has been pronounced as incurable. He is only 22 years old. He comes from a very fine family.

I have a very dear friend, a member of my class, whose boy this year entered Yale as a freshman, and he never kept up with his class. His father was very much discouraged. That boy was examined, and we found a patch as big as a half dollar on his left lung of tubercular infection, and the boy has been taken out of college and sent away.

When you are brought into contact with those experiences, and when you stop to think what science has done for humanity and civilization in the last 25 years, I fail to see where anybody can present any argument to combat the wishes of the people who are willing to make sacrifices to counteract these ravages which are

injuring humanity. I want to leave this thought with you, simply that there is a group of men, I believe, competent to produce results if they are only given the opportunity to produce what they wish to carry through, and we are only down here to give support to this enterprise which Senator Ransdell has fixed our attention on.

Senator SACKETT. Does the Rockefeller Institute go into your branch of the work?

Doctor JOHNSON. They are cooperating very closely. Doctor Sabin is their real cooperator.

Senator SACKETT. They support that?

Doctor JOHNSON. Yes, sir.

Senator SACKETT. Is there any other private support?

Doctor JOHNSON. The other support is that given through the Sprague Institute of the University of Chicago, where we have Professor Styles and Professor Long as pathologists who are interested in the work. We have also Professor Cunningham of the University of Nashville, where we get cooperative work. We also have cooperation with Doctor Pinner, who is at the Northport Sanitorium of the city of Detroit. His work coordinates with ours.

Senator RANSDELL. But there is no private fund specially for that purpose?

Doctor JOHNSON. There is no private contribution in support of these activities outside of the contributions of the National Tuberculosis Association.

Senator SACKETT. What does that amount to?

Doctor JOHNSON. I do not know.

Senator RANSDELL. What does this amount to in your own institution?

Doctor JOHNSON. We are spending about $15,000 a year.

Senator RANSDELL. How much of that does this National Tuberculosis Association contribute?

Doctor JOHNSON. I think probably about two-thirds, roughly.

Senator SACKETT. Do you get anything from the Rockefeller Foundation?

Doctor JOHNSON. We do not get anything from them.

Senator RANSDELL. Doctor, do I understand from your own experience in your great university that you feel very much encouraged to think that we can some day find the cause of consumption and prevent it?

Doctor JOHNSON. I certainly do.

I might add a word here, we have an instance of research right here in your own Government on a small scale, but it is operating at the present time. It was simply through the contact with Doctor Woods of the Agricultural Department who was director of research problems there. We were very much interested, for example, in the activity of sulphur combinations in blood and through Doctor Woods's initiative, and Secretary Jardine, we have instituted a cooperative piece of research that has been running for the past year.

Senator RANSDELL. That is to prevent tuberculosis?

Doctor JOHNSON. Indirectly it will lead up to that same consideration. I sent one of my own men here this last fall to Washington to give assistance to this staff in order to focus and coordinate in work that we were interested in. I mention this simply to show that it is possible to introduce these cooperative plans, which is desirable.

Senator RANSDELL. Will you not elaborate a little bit, Doctor, on what you think coordinated effort on the part of our Government should be to bring about better results than have been obtained by private institutions, even your own great college? How would science of every kind, not only of life of human beings, but the laws relating to animals and plants and everything in relation to human life—how will the establishment of the Bureau of Health produce better results than have been obtained in the past by private efforts?

(At this point the members of the committee were summoned to the floor of the Senate to answer a roll call.)

Senator FLETCHER. Have you gone far enough to say whether you contemplate reaching this problem by discovering the names of these different bacilli or cells and destroying them in some way by medicine?

Doctor JOHNSON. It is hard to formulate a conclusion yet on the basis of our present work.

Senator FLETCHER. You have not reached the question of remedy as yet?

Doctor JOHNSON. No. Our work has been in progress for only two years. We can not formulate a result in that time.

Senator RANSDELL. You have taken advantage of what has been going on for a number of years and working on it?

Doctor JOHNSON. The chemical attack is new.

Senator RANSDELL. Would you be able to stay to-morrow? If not, we will have to let you finish to-day and get it into the record.

Doctor JOHNSON. I can come back to-morrow morning.

(Thereupon, at 3.20 o'clock p. m., the subcommittee adjourned until to-morrow, Wednesday, April 25, at 11 o'clock a. m.)

PROPOSED NATIONAL INSTITUTE OF HEALTH

WEDNESDAY, APRIL 25, 1928

UNITED STATES SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON COMMERCE,
Washington, D. C.

The subcommittee met, pursuant to adjournment, at 11 o'clock a. m., in the room of the Committee on Commerce in the Capitol, Senator Joseph E. Ransdell presiding.

Present, Senators Ransdell (chairman), Sackett, Fletcher, Stephens, and Copeland.

Senator RANSDELL. The committee will come to order. Doctor Johnson, you were testifying when we recessed. Will the reporter read the question that I asked.

(The question was read by the reporter as follows:)

Senator RANSDELL. Will you not elaborate a little bit, Doctor, on what you think coordinated effort on the part of our Government should be to bring about better results than have been obtained by private institutions, even your own great college? How would science of every kind, not only of life, of human beings, but the laws relating to animals and plants and everything in relation to human life, how will the establishment of the Bureau of Health produce better results than have been obtained in the past by private efforts?

Doctor JOHNSON. That is a very broad queston, Mr. Senator.

Senator RANSDELL. I intended it to be, but I think we had better try to answer it.

Doctor JOHNSON. It can be answered in sections. I would like to answer it by presenting my reply in the form of different statements.

Senator RANSDELL. Answer in your own way, Professor.

Doctor JOHNSON. Now, in the first place I think we all should understand or do understand that we have a great many problems to be solved that the present resources can not be expected to undertake and handle, and as we go into research, and research grows and extends, the problems multiply, and that our resources must be expanded. Now as we have expansion, as these problems begin to be exploited and studied, it calls for close coordination in order to be able to focus on the features of your research problems which are of the greatest importance. In other words, I think there is a quite general feeling that a little of the work that is being done now is perhaps duplication, simply because of the fact that we have no machinery, no organization under central control where these various efforts and activities can be brought together, and we can have a council around a table like this, and all these activities can be focused and direction given to the best efforts of the research.

Senator COPELAND. Would there be any conflict between the various private agencies and this governmental institution?

Doctor JOHNSON. I do not see how there could be. I am not very familiar, Senator Copeland, with the machinery of control in Government circles.

Senator COPELAND. This is a fact, is it not, that with the spirit of the private institutions and the spirit of the men in charge, there would be no jealousy and no conflict and no uncomfortable overlapping of effort and that there could be coordination of activities so that we would be going forward toward the goal of perfect health, making practical use of all the machinery without any squabble?

Doctor JOHNSON. I do not think so. I think for example in my contact with men interested in this problem that there is a general feeling that we would all benefit and that the work would benefit by some organization of machinery of control that would help keep our units together and make more rapid progress.

Senator COPELAND. That is brought out in section 3 where it says that individual scientists may be designated by the Surgeon General for the prosecution of investigations in other localities and institutions in this and other countries during the term of their fellowships. So that for instance, if cancer were being under investigation in a governmental laboratory and some work was being done by the Harvard Medical School, or some other institution, the scientists could exchange places for a time to familiarize themselves with the work and place the Government man in Harvard and the Harvard man in the Government institution.

Doctor JOHNSON. Absolutely. One of the finest features of our tuberculosis investigations, Senator Copeland, is this feature where we have these various workers in their own isolated fields interested in the development of this subject. One of the finest features is to go to one of our meetings where we call in outside experts who have not had intimate contact with the individual technique, and where we can sit down around a council table and reveal our story to them and get their counsel and advice, and to look at it from another viewpoint, not having intimate contact but by having that opportunity to hear our story, and they react upon it and return to us how the work impresses them, and add its true value. We get more real good from that as coworkers than from any other contact we make.

Senator RANSDELL. Doctor Hunt brought out the fact that there has been very fine work done in foreign lands in the interest of health. Section 3 also provides that scientists may be designated for the prosecution of investigations in other localities and institutions in this and other countries during the term of their fellowships. Wouldn't you imagine that great good might come from having a great national institute here that could send its men to other countries?

Doctor JOHNSON. I would like to add to that that I have had just recently in my own laboratory in New Haven a visit from two foreign professors, Professor Paul Walden, who discovered the Paul Walden inversion. I said I was going to keep away from technical terms, so we will not discuss what that is. I have also had a visit from Professor Frankel, of Austria. We were interested in some delicate matters dealing with tubercular cells and the cancer problem. There are never enough well trained men in Austria or in Germany, but for some two or three thousand dollars a man could be brought to this

country for six months. You would get that inspiration or contact with people who are doing the best work here or instituting that kind of cooperation and bringing out our field of activity and such an organization would be at liberty to invite a foreigner to this country to make his services available.

Senator COPELAND. He would be at the laboratory of your college or university?

Doctor JOHNSON. Yes, sir.

Senator COPELAND. That is the kind of duty the institute would be expected to perform?

Doctor JOHNSON. Absolutely.

Senator COPELAND. Is not there this further point? I found myself, when I was commissioner of health of New York, often embarrassed for lack of funds for specific investigations. It might well—not in a richly endowed institution like yours—but take it as an example, it might happen that you had no funds to send one of your research men to Freiburg or Heidelburg, or some other place, to study the methods used, the technique used over there. Now, if you did not have the funds, this institution could give an appointment to one of your scientists and send him over for the investigation such as you desired to make?

Doctor JOHNSON. Absolutely so.

Senator COPELAND. There would be times when it would be very desirable.

Doctor JOHNSON. There would be. In fact, Senator Copeland, if I wanted to get $5,000 additional money next week to exploit a thing I am interested in to-day, outside of the budget which is provided for me, if I should empyrically develop something that should be followed up, and I knew that it was a very essential thing to do, where would I go to get the money? There is not a place where I could make an appeal, go to any philanthropist, that would see the connection of my problem with the problems that the Health Service is interested in, no place where I could get that private support.

Senator COPELAND. And yet that work would be very essential; is very essential?

Doctor JOHNSON. It is part of the whole story. It has got to be done.

Doctor HERTY. I believe Doctor Johnson will permit me to step in a minute and mention a point that arose in connection with his own work. I visited Professor Johnson in his laboratory about a year ago. I had previously sat in a meeting at Rochester, N. Y., and had learned for the first time of the work of a man named Anderson at Geneva, N. Y., who had wonderful qualifications in working on certain constituents of the tubercular bacilli which was very necessary to the work that Doctor Johnson was doing. He brought him down there, but the night I saw him he was worried as to how he could get the funds to keep Doctor Anderson on the work longer, and he talked with me for about an hour, puzzling how to get the $5,000 needed. After some persuasion, President Angell added him to the staff. My thought is that there is a Nation suffering with tuberculosis in every section, and a piece of research work is thoroughly under way which was about to be halted for the lack of $5,000.

Senator RANSDELL. That is an illustration of many other things that might come up.

Doctor HERTY. With an institute of this kind, Professor Johnson would be able to apply to it and the Government would detail at once a fellow of this institute to carry on this particular work.

Senator RANSDELL. Right there, Doctor Johnson, you will note that this bill would authorize you to send to this institution.

Doctor JOHNSON. Yes.

Senator COPELAND. Is it not a fact—the reason we ask these questions is because we know it is a fact and we want the record to show it as a fact—an independent research worker starts out with a line of activity that gives promise of developing into something really useful, and yet he has no funds and you have no funds, and there is no way to give this man the wherewithal to continue a line of research that may be very beneficial to the human family?

Doctor HERTY. You can find men of that type throughout the country, and their work has to come to an end because they have no funds.

Senator COPELAND. Such an institution as Senator Ransdell promises would provide facilities to make it possible to bring this man from the place where he is, Arizona or Detroit or wherever he is, to bring him to this institution, or to take him to Doctor Johnson in his laboratory to act with him in connection with the work he is undertaking.

Doctor HERTY. The Surgeon General has tc see that this is properly done.

Senator RANSDELL. Instead of interfering with your intitutions we would be holding up your hands and aiding you in your work.

Doctor JOHNSON. There would be absolutely no conflict, in my opinion.

Senator RANSDELL. It would be helpful to you.

Doctor JOHNSON. Yes, sir.

Senator COPELAND. I am anxious to make it clear that every privately endowed institution in America, every individual research worker, everybody interested in finding out the cause of disease and the ultimate cure will be aided and benefited by such an institution as this. Am I correct?

Doctor JOHNSON. You are.

Senator RANSDELL. You may proceed in your own way, Professor. You had not finished, had you?

Doctor JOHNSON. I wanted to give one more illustration before I stop.

Senator RANSDELL. I do not want to cut you off. I want you to proceed in your own way.

Doctor JOHNSON. I want to give an illustration in order to reveal a condition that pictures exactly the situation we are up against. I notice in the morning newspaper that Bennett is suffering with lobar pneumonia in Canada, and it was necessary to try out the latest discovery for the cure of pneumonia that we could utilize to save that man's life. You have had the response of the hero in the public eye at the present time, Lindbergh, who flew yesterday afternoon from Mitchell Field, N. Y., with a representative of the Rockefeller Institute with the latest serum preparation to transport to his bed to give him immediate relief if possible. Now the important part is

that the remedy will not meet the response to save the man's life. There is an illustration. They are using a chemical product that we have developed up to a certain point. There is an illustration of where we are just balked, right up against a stone wall, and it is only typical of several illustrations that we could bring out of our limitation and what we are trying to overcome. We have just reached a point where a great many people in this country interested believe that with the resources of science that can properly be directed, and with this call before us we can achieve what we achieved by sending that airplane up yesterday afternoon. There is a typical illustration of the situation. But we are simply balked. We can not proceed any further until we know more about pneumonia and know more about the structure of antitoxins. But the Rockefeller Institute is to be congratulated on having brought its discoveries up to the state of perfection it has.

Senator RANSDELL. But there is a great deal more to be found out?

Doctor JOHNSON. We have only just commenced.

Senator SACKETT. Will you give us some idea relative to the work you are doing? Is it different from the work of the Rockefeller Institute, or are they doing the same work?

Doctor JOHNSON. No, Senator; it is not similar. In the development that we are interested in in this particular feature of activity that is being supported or helped by the Tuberculosis Association, we are laying emphasis primarily upon the principles of chemistry and the utilization of the principles of chemistry for the study of diseased conditions, and we are taking as a specific example the tubercular cell. The work that is being done by the Rockefeller Institute, while it is first class, is, for example, more of a pathological and a purely medical feature. You see what I mean.

Senator SACKETT. I was trying to bring that out.

Doctor JOHNSON. In other words, the majority of their work is clinical. We are making contact with the Rockefeller Institute. My chemists in the Yale laboratory are doing work on the tubercular cell. We are applying our chemical intelligence to breaking up the cells into specific fractions and getting those fractions for investigation. The major clinical work is being done for us by cooperation with the Rockefeller Institute. By bringing those two forces together and coordinating them, we are approaching a new development, a new feature that they could not undertake without cooperation from the chemical points available. The products would not be available.

Senator SACKETT. You are going further back than they started?

Doctor JOHNSON. Yes.

Senator SACKETT. As a result of the work further back, it gives them a foundation on which to build their pathological work?

Doctor JOHNSON. That is primarily the whole story. We are trying to get down to fundamental research, and if you go to fundamental research you go back to the cell from which all these organs grow and learn something about the cell. What we are doing is to apply the principles of two fundamental sciences which are the sciences of physics and chemistry. They are the basis of all of our work.

Senator COPELAND. You know, Mr. Chairman, our witness has spoken about Lindbergh going to Quebec. It is a spectacular thing and we would not belittle it for the world, but he took with him a product which required research and study and bravery and the

possibility of infection of the research workers. When I look in imagination to the foundation of the remedy which Lindbergh took, it seems to me that great as is Lindbergh's feat, it does not compare with what was taken in the hands of Lindbergh to the bedside of this sick man.

Doctor JOHNSON. I might introduce another fact which I think illustrates the condition that we are operating under. Now take a man like Doctor Anderson, on whom is placed a great deal of responsibility in these activities. There is a man drawing his salary from three sources, in order that we may keep him. We do not have the money available in our university because he is an unproductive teacher. He does not handle students. He does research work. A part of the salary is paid by Yale University, part by the National Tuberculosis Association, and the rest of his salary is supplied by the Rockefeller Institute—three different paymasters are contributing to the salary of this investigator. I think it is a poor condition to work under. I think that we in our researches in this country ought to have a little better situation than that. You can just imagine the feelings of an investigator like Doctor Anderson if he knew his salary is being made up from three sources. He has been given the title of professor by the university, and this is what is done to keep him there. It is not the right atmosphere for the research worker like that.

Senator RANSDELL. We aspire to leadership, it seems to me, leadership in everything in this great country of ours, but if the story painted by Doctor Hunt yesterday is correct, we certainly lack a great deal of having leadership in the problems of health.

Doctor JOHNSON. We are not in leadership yet.

Senator RANSDELL. We are behind several countries?

Doctor JOHNSON. Yes, sir.

Senator RANSDELL. That hurts my pride.

Senator COPELAND. We are taking advantage of the remedies that other countries have given us. We have developed our own methods, but we have not contributed so much as we ought to the benefit of the world's population.

Senator RANSDELL. That seems to be true, and yet we are so populous and wealthy that we ought to do everything to at least bear our fair share of the burden of that kind, not to exceed other countries, but to equal them.

Senator COPELAND. Now I think I understand you. You have made clear to us that privately endowed institutions are not endowed richly enough to carry on all the problems which present themselves and problems which seem to be solvable if you had the men and money to carry on the work.

Doctor JOHNSON. I am positive of that.

Senator COPELAND. And therefore we can not, as a nation, begin to do the work which is here before us and which can be done if we have the men and money to carry on the work?

Doctor JOHNSON. No, sir.

Senator SACKETT. Let me ask you, Senator Ransdell, about the situation from a practical standpoint. We are very close to the end of the session. If we are going to get this bill through this session, it is almost necessary that it be reported in to get proper position without delay. The object of this subcommitee is to get the opinions

of these gentlemen and get sufficient information to defend and promote this legislation upon the floor of the Senate?

Senator RANSDELL. Yes.

Senator SACKETT. I would like to ask if you think the committee is sufficiently informed, if you think that your students have grasped these points sufficiently to present it to the community at large?

Senator COPELAND. The witness might hesitate to ask you.

Senator SACKETT. I am not asking that question. What I am interested in now is, if you gentlemen feel that you have got a grasp of this subject, if you have considered whether the bill is in the shape in which it ought to be presented to the Senate. Because it seems to me that if needs some doctoring—I do not like to commit myself to a bill until I know how it is going to be amended.

Senator COPELAND. Why do we not, in the presence of these experts, go over the bill and see what it needs.

Senator RANSDELL. If you gentlemen will bear with me, I should like to put on one or two more general witnesses.

Senator SACKETT. We have not much time, Senator.

Senator RANSDELL. I am not going to take a great deal of time. I was also going to ask Doctor Kerr, of the Public Health Service, who has been doing practical work in the Public Health Service. So far as it has gone it has done magnificently and we want any sugegstions that he can give, and Doctor Herty has been working at this thing for more than a year, and he has some practical ideas that I would like to inject—we will not take very much more time, I would say—and then we will get down to practical work.

Senator SACKETT. That is what I wanted to call to your attention.

Senator RANSDELL. I am not going to devote a great deal of time. We have a number of letters, I would say, from prominent physicians and scientists, statisticians, and others, and we can put them in the record with very little consumption of time. I think we can finish this afternoon the general hearing.

Now, would the Senators like to ask Doctor Johnson any other questions? Or would you like to say anything else, Doctor?

Doctor JOHNSON. I might add another point here, and that is the development of personnel to work on these research problems in this country. Now in connection with this question of fellowship, I refer to this possibility of bringing trained investigators from abroad. Do you realize that one of the things that we observe to-day in our academic institution is that the boy does not have properly put before him the possibilities of science and what the field opens up to him for the future. We do not have enough of our boys choosing technical and scientific courses. Our manufacturers are just crying for that type of trained people. We do not have a large enough proportion of our boys choosing science. Our boys are choosing courses in the humanities—literature and other subjects. It might be due to the wealth of the people sending these boys to college. But anyway we do not get enough men to go into scientific work. I think there should be some organization by which these possibilities can be brought before these young men. The boy going to West Point knows what is before him. They are going to take care of him and the same way with the boy going to Annapolis. Why should we not, as a government, promote the activities in other fields of service, where we need well-trained personnel and have a field opening up

for these boys, and inspire and direct minds into these fields where they do not see opportunities? I can see all kinds of national advantages in an undertaking like this, where you have contact with large educational institutions like Yale. We have many young men floundering, not knowing where to turn. They ask, "What would be my earnings in that field of service?" If we have a well-organized association under Government control and Government inspiration which is stimulating that thought and interest among these boys, I am going to predict that you are going to get some good blood, and you will need those fellows in future years, and I maintain that if the fellowship system incorporated is of this type, the plan would be most valuable to this whole program of getting a strong personnel of people interested in this type of problem. This is an important feature.

Senator RANSDELL. That is very important, in my judgment. You agree that rich people would probably be delighted to help out the Government. I am not appealing to the rich. I think the Government is rich enough to do all this by itself.

Doctor JOHNSON. Two years ago I was called to a conference with the Surgeon General's office in connection with the cancer problem. I went home later and met an influential man in New Haven who wanted to meet me. He lost his daughter two years ago from cancer, and he said to me that he would like to do something for this cancer situation, but he said, "I am a little bit inclined to hold back my funds because I do not think that the organizations that are conducting the cancer program really know what they ought to do, where they ought to focus their attention." He said that the work was split up into too many units, and that there was no coordination, no directed effort.

Senator COPELAND. He thinks also, by reason of that, that the funds will be wasted and dissipated?

Doctor JOHNSON. The thought he left with me was that if there was some organized effort relating to the problem which could have better control and get the best services contributed to that investigation there would be a lot of funds made available to meet the situation.

Senator RANSDELL. Supplementing what the Government sees fit to appropriate?

Doctor JOHNSON. Absolutely.

Senator RANSDELL. We thank you very much, Doctor Johnson.

I would ask Doctor Camalier to take the stand and make such a statement in regard to this legislation as he desires.

STATEMENT OF DR. C. WILLARD CAMALIER, MEMBER OF THE LEGISLATIVE COMMITTEE OF THE AMERICAN DENTAL ASSOCIATION

Doctor CAMALIER. Mr. Chairman and members of the committee, I am sorry that I can not appear this morning with the indorsement of the American Dental Association. For some reason the bill did not come into our hands until about 30 or 60 days ago, and of course the American Dental Association has not had a meeting since August. We will have a meeting this coming August in Minneapolis. But from the sentiments expressed by the other members of the legis-

lative committee, and high officers of the American Dental Association, I feel that there is no question that this bill will be indorsed.

I speak from a personal angle, yet I feel that I am voicing the sentiment of the legislative committee of the American Dental Association.

We are naturally interested in three problems. We would like to know more about the cause and cure of pyorrhea. We would like to know more about the cause and cure of caries, and focal infection in relation to systemic diseases. If we had scientific data, then we could do for the public an immense amount of good that we can not do due to lack of authoritative knowledge. It seems to me that such an institution as this that is proposed is a wonderful plan. Senator, I do not see how there could be any objection whatsoever from any source. The money consideration should not enter into it at all. You have your Bureau of Standards for testing materials, you have your Bureau of Animal Industry to study animal life. Why should you not have a national institute to study human anatomy. It is a very practical proposition and it seems to me that there could be no objection whatsoever to it.

Now, just along that line, the American Dental Association has just recently placed a research worker in the Bureau of Standards. I should like to be assured under this bill that we could do that in this national institute of health, and I notice under the last section that you refer particularly to the facilities being granted to municipal authorities, etc. Would it not be wise—this is merely a suggestion to you—to add this phrase, "And likewise to private scientific and professional organizations, in the judgment of the Surgeon General." Or is that point taken care of in some other section of the bill?

Senator RANSDELL. I am not absolutely certain. The spirit is to take in every branch of science that would engage in research work relating to the problems of health. That is what we intend, and we would be glad to enlarge the bill—so far as I am concerned—to follow your suggestion, if necessary.

Doctor CAMALIER. Now, if the committee will bear with me for just a few minutes, I will read this letter from the chairman of the legislative committee. [Reading:]

COLUMBUS, OHIO, *April 21, 1928.*

Hon. JOSEPH E. RANSDELL,
Chairman Commerce Subcommittee,
United States Senate, Washington, D. C.

MY DEAR SENATOR RANSDELL: I have been ill for the past week and regret that it will be impossible for me to be present at the hearing scheduled for the 24th on your bill, S. 3391. However, I am going to briefly set forth certain facts with reference to the attitude of the American Dental Association toward all public-health activities.

Our association has approximately 35,000 members and the present-day requirements of practice demands that the dentist be far better informed in all matters relating to health and disease than was considered necessary a few years ago. All professions interested in health matters, as well as the laity, are appreciating our close relation to all such problems and it is a generally recognized fact that there is a constantly increasing stress placed upon the prevention of disease rather than its cure.

I desire to commend you upon your high and far-reaching ideals, which you have embodied in S. 3391, in order to create a broad and constructive health program. The enactment of such legislation will go a long way toward minimizing the physical disabilities of our citizenship and, in the end, this will increase the number of producers and at the same time decrease the number of nonproducers, who are becoming more and more an outstanding liability as the expense

of caring for the physically unfit is constantly increasing from year to year. Therefore, whatever effort can be put forth to minimize disease on the one hand and build up the physical resistance on the other, should be encouraged. It is recognized by all serious-minded persons, who give this subject any consideration, that the question of health is fundamental and of supreme importance, but unfortunately, in the practical application of our everyday experience, many are prone to neglect this important problem and apply their energies in other and far less important directions.

In the first section of your bill you make provision for conducting "scientific research in the fundamental problems of the diseases of man and matters pertaining to health." This is a highly essential initial procedure, in order to accomplish the best possible results. In this connection, I think I am justified in saying that the American Dental Association has recognized the necessity for similar research work and we have been expending considerable time and money in carry-on researches in various universities and institutions for the past 14 years, and at present, we are spending of our own funds approximately $35,000 per year. Our plan is to appropriate funds to institutions and universities having research workers and facilities, thus stimilating them to put in their own funds in such cooperative research. As a rule, these institutions will furnish the research worker and we pay their technicians and certain other items of expense. We have just recently started some cooperative research work at the National Bureau of Standards and we are appropriating $5,000 annually for this purpose, and we have a research associate cooperating with those at the bureau in some very important research problems. We are also contributing to a swine research problem in connection with Johns-Hopkins University, which is being conducted at the experimental farm between Washington and Baltimore. While we are spending approximately $35,000 annually, yet this amount is only a small item as compared to the total amount which our appropriations have stimulated in developing from the cooperative institutions.

Further, the carrying out of the provisions of your bill will afford the best possible opportunities of developing a group of well qualified scientific persons in order to best meet the needs of to-day in disseminating authoritative public health educational data.

Our association has taken a very active part in promoting H. R. 11026 and S. 3356, but this particular legislation was unanimously approved by the House of Delegates at our last annual meeting. S. 3391 has never come before our association for official action and therefore, in harmony with the policy of our committee, it is not possible for us to speak officially and authoritatively for or in support of your bill except in such general terms as I have already used. However, I think from what has been stated that you and your committee will readily appreciate the fact that the American Dental Association is vitally interested in any program which tends to develop additional safeguards for the public, which in the end, will assist in establishing and maintaining the highest possible public health standards.

Dr. C. Willard Camalier, Medical Science Building, Washington, D. C., is a member of our committee and I will send him a copy of this letter and request that he appear before your committee and present my written statement and add to it such further data as he may desire to present, as well as answer any questions you or your committee may wish to ask.

Respectfully submitted.

HOMER C. BROWN,
Chairman Committee on Dental Legislation,
American Dental Association.

Doctor Brown necessarily has to be a little careful in what he says, but personally I feel there is no doubt that the American Dental Association will be glad to back such a worthy project.

Senator RANSDELL. Personally you indorse the bill, do you?

Doctor CAMALIER. Absolutely.

Senator RANDSELL. And you do not see that it would interfere with the work of any other institution or organization?

Doctor CAMALIER. Not at all.

Senator RANDSELL. It would be helpful to all of them, as Professor Johnson has noted?

Doctor CAMALIER. I should think so; yes.

Senator COPELAND. Your suggestion is that in section — we add some such language as this, "The facilities of the institute shall from time to time be made available to bona fide health authorities of States, counties, or municipalities," and then insert, "and to institutions devoted to research in health and disease"?

Doctor CAMALIER. Yes, that would cover it. Would you want to add "in the judgement of the Surgeon General"?

Senator COPELAND. Of course that is stated in the preamble. It is under the administrative control of the Surgeon General.

Senator RANSDELL. We are very much obliged to you. We have just a few minutes left. Doctor Kerr, do you wish to take the stand? Please state your full name and your position in the Public Health Service.

STATEMENT OF SURG. J. W. KERR, UNITED STATES PUBLIC HEALTH SERVICE

Doctor KERR. In authorizing Assistant Surgeon General Stimson and myself, Mr. Chairman, to appear before the committee, the secretary in his letter of the 19th addressed to the committee stated in the last paragraph as follows:

> In accordance with your request, Drs. J. W. Kerr and A. M. Stimson will be directed to appear before your subcommittee. In this connection I invite your attention to the fact that apparently a similar bill introduced during the last Congress was disapproved by the Bureau of the Budget as being in conflict with the financial program of the President.

Senator COPELAND. Yes; we are entirely familiar with that fact. It does not frighten the committee at all.

Doctor KERR. With your permission, Mr. Chairman, I will direct my remarks to the development of public health research by the Federal Government, and its importance, and to try to answer such questions as the committee may ask.

Senator RANSDELL. Very well.

Senator SACKETT. Has that financial program been changed?

Senator COPELAND. It will be at the time of the next election.

Senator SACKETT. I am asking it as a matter of fact.

Senator RANSDELL. We have not had any formal report on this particular bill, but last year a report was made indicating that the bill was not in accordance with the financial program of the President.

Senator SACKETT. Nothing has come this year?

Senator RANSDELL. Nothing in regard to this. He simply reminds us that a similar bill was up last year, and that it was not in accord with the financial program of the President.

Senator SACKETT. Has it been submitted?

Senator RANSDELL. No, sir; it has not been submitted. Frankly, I wanted to hold these hearings and to have them for the Bureau of the Budget. It will be submitted when this hearing is closed. I know that we would get the same report if it should be submitted before this hearing, therefore I did not submit it.

You may proceed, Doctor Kerr.

Doctor KERR. Public-health research and all the activities for the protection of the public health is probably the most legitimate and most important with which the Federal Government has to do. It is

a remarkable fact, however, that authorization for research was not granted until 1901. During that year Congress authorized investigations of contagious and infectious diseases and matters pertaining to public health in the Hygienic Laboratory, and provided a building for that purpose. A year or two previous to that a special authorization had been granted the Public Health Service to make a study of the prevalence and the public-health improvement of leprosy. In 1902 Congress provided a division of scientific research in the administrative bureau of the Public Health Service, and in 1905 authorization was given for systematic studies of leprosy in the island of Molokai. Those studies have been going on ever since. With these authorizations, the work was begun in an evolutionary manner and the subjects that had been pressing the Public Health Service for investigation were taken up; those that related to the administration of quarantine and the handling of such sanitation as was carried on at that time, but it soon became evident that certain mass investigation should be undertaken, and the first of these was organized and begun in the District of Columbia in 1906. It related to typhoid fever. It was conducted for a period of four years. It involved chemical, bacteriological, and epidemiological studies. The personnel that carried it on was already engaged.

Prior to that time the studies of hookworm diseases had been carried on, and with the facilities available we were developing the extent of this disease in the United States and its bearing on the public health. I think the typhoid fever investigation had a very wide influence in stimulating the investigation of these diseases and the general development of the studies of epidemiological diseases, and the results are shown of all these studies, including our own and those of the State and local health authorities, in the great reduction of typhoid fever that has occurred since 1900. In 1900 the death rate from typhoid fever was 35.7 per 100,000 and in the last year it was 6 per 100,000.

The next systematic studies that were taken up were devoted to milk and its relation to the public health. They were the direct outcome of the studies of typhoid fever, because 10 per cent of the typhoid fever in the District of Columbia was shown to have been due to milk infection. That work was carried on systematically until 1911, and work of course has been done from time to time since then.

I think we are all familiar with the advances that have been made throughout the country in milk investigations that have been conducted. Excellent investigations have been conducted in many other places, and ours have been supplemented by those investigations.

Senator COPELAND. The New York board of health did a lot of work.

Doctor KERR. It has been a leader in many lines of investigation, especially in the line of tuberculosis and in the investigation of tenement-house conditions in the city of New York.

Our authorizations and our facilities required us to work around Washington and in the vicinity of the Hygienic Laboratory. But in 1912 broad general authority was granted for field investigations. The wording of the law, of the pertinent portion of the law, is as follows:

The Public Health Service may study and investigate the diseases of man and conditions influencing the propagation and spread thereof, including sanitation, and the pollution, directly or indirectly, of the navigable streams and lakes of the United States.

This, taken in conjunction with the authorization for laboratory studies, Mr. Chairman, in my opinion, gave us as broad authority as is necessary for the conduct of investigations relating to the public health. Of course that is the authorization for the planning and conduct of studies. The question of facilities is an administrative matter and one for Congress to decide.

Senator COPELAND. Of course you are given larger powers in the bill which has just passed, in the way of establishing new bureaus.

Doctor KERR. It is an additional step. When the Hygienic Laboratory was organized in 1901, it had four divisions. There are four at the present time. There is urgent need—and Congress has met that need in the passage of the bill yesterday—for the creation of new divisions. The progress of investigations of public health has been very rapid, but as time has gone on the problems presented for solution have become very complex.

Under the act of 1912 various investigations covering generally the main subjects of health and disease were outlined, and estimates were submitted to Congress and the appropriations have increased some from year to year.

In the beginning of the work in the Public Health Service the investigations were more or less of an individualistic character, and I think that is true throughout the country. The science of bacteriology had just been established, and undue mortality and morbidity throughout the country on account of insanitary conditions stimulated greater interest.

Senator RANSDELL. Pardon me; that is a roll call. Could we come again at 2 o'clock?

Senator SACKETT. I would like to ask one question before we go.

Senator RANSDELL. Yes.

Senator SACKETT. Have you read the first section of the bill in which it says:

That the Secretary of the Treasury is authorized and directed to establish and operate a national institute of health under the jurisdiction of his department and the administrative control of the Surgeon General of the Public Health Service, which shall be devoted to scientific research in the fundamental problems of the diseases of man and matters pertaining to health.

That is the only direction in the bill, as to the purpose of the bill. In your judgment, is that a sufficient designation of the purpose?

Doctor KERR. I have read the bill, Senator, and my impression was that the language of the preamble gave broad authority for the investigation of problems.

Senator SACKETT. It is purely administrative as to what they can do and as to the way they can do it. That is the only thing in the bill as to the purpose of the bill.

Doctor KERR. Yes, sir; that states the purpose of the bill. It is in reality a reaffirmation of the law that already exists, because I believe that the law already adverted to, and the one I have read, have very wide authority for investigations within the limits that Congress would provide funds and facilities to engage in.

Senator SACKETT. Does not the present law furnish that same privilege to the Public Health Service right now?

Doctor KERR. I think Senator Sackett, that this is a reaffirmation, could be considered as a reaffirmation of the existing law, but that it mentions fundamental problems, and that we are now realizing that fundamental problems throw light on concrete problems. Heretofore the public and the governmental establishments have looked to the medical profession largely for advances in medical science and public health. I think in the future we may look to the physicists and chemists and other scientists to bring out new facts which will be the keystones to tie together perhaps existing knowledge and enable us to solve problems that we have been unable to solve in the past.

Senator SACKETT. It rather limits this whole thing to fundamental problems. If you leave out fundamental problems, it would leave them all out. All problems are fundamental, medical or what not.

Senator RANSDELL. I would like to say that the spirit of the promoters of the bill was to reach all problems, and if that word "fundamental" is to limit us, we will certainly eliminate the word.

Senator SACKETT. Those are the questions that are going to be asked about the bill.

Senator RANSDELL. Notify the witnesses that we will come back at 2 o'clock.

(Thereupon, at 12.05 o'clock p. m., the committee took a recess until 2 o'clock p. m.)

AFTERNOON SESSION

The subcommittee met, at 2 o'clock p. m., pursuant to the taking of the recess, Senator Joseph E. Ransdell (chairman) presiding.

Senator RANSDELL. The committee will please come to order. Doctor Kerr, will you please resume your statement?

STATEMENT OF SURG. J. W. KERR, UNITED STATES PUBLIC HEALTH SERVICE—Resumed

Doctor KERR. Mr. Chairman and members of the committee, at the previous session I was reviewing some of the evolution of the public health investigational work since 1901, and I had just pointed out that in the beginnings of research the efforts were more or less individualistic. They were inspired by the growth of new sciences, the unduly high mortality and morbidity, and the wholesome rivalry existing between institutions to bring out one fact after another. From the Federal public health standpoint, we have realized more and more as the time went on that public health research must be in the nature of a cooperative plan, and it must include sciences from a number of different fields. The very first investigation undertaken, in fact, after I was assigned to duty as chief of the division of scientific research related to typhoid fever and involved epidemology, chemistry, and bacteriology. All subsequent investigations have presented this same problem.

In 1907, pellagra was first reported in the insane asylum of Tuscaloosa, Ala. This was the first outbreak reported in the United States. The disease had prevailed in Italy and certain other parts of Europe for 100 years and been the subject of more or less investigation. Certain statements regarding its possible cause were rather well supported, and it seemed as though it was necessary to enlarge on the

investigation, and in planning for our studies we utilized the services of epidemiologists, chemists, bacteriologists, psychiatrists and others, and we have studied that disease for approximately 20 years. When we began, the cause of the disease and the methods of prevention were just as obscure as cancer is to-day. The progress was slow with us, but we feel now that we have determined the essential cause of pellagra.

Coincident with the work, however, new lines have been taken up, new problems of nutrition, and those are the problems that will require study and advancement, and on account of the increased complexity of these problems, greater specialization in the future will be necessary than in the past.

Senator RANSDELL. Has not the study of pellagra involved the general problem of diet, what constitute healthful diet for the human being? Has not that been necessary in working out your pellagra problem?

Doctor KERR. It was found that unbalanced diet was the essential factor, and that was immediately made available to the medical profession. It was strikingly impressed on me during a trip in northern Alabama. We were driven out in a mountainous region, and stopped at the office of a doctor. I asked him if he had any pellagra. He replied that he had had some, but that he did not have any now. "What did you do for them?" "I fed them milk, eggs, and meat." That was the attitude he had taken, and that was the attitude of the practitioners and the people generally throughout the South, and the disease which looked as though it was going to sweep the country in 1911 has now ceased to be a serious menace.

Senator RANSDELL. And your bureau has worked that out by very persistent and cooperative effort of a number of different scientists?

Doctor KERR. The results we have obtained are due to the cooperative work that was necessary and to its persistence over a period of years, otherwise we would not have been successful. That is one of the advantages of Governmental research. It should be one of the greatest assets of the public in research. After a plan is determined to be a good one, it should not be interrupted so long as there is any hope of a solution of the problem along the lines of the original plan. That is shown with us in many other diseases, especially Rocky Mountain spotted fever, tuleremia, and other diseases that we knew nothing about years ago, and now we have thrown some light on them, and these studies have raised new problems and some of them will require fundamental studies of basic scientific character in order to solve them.

Senator RANSDELL. These studies, I take it, Doctor, were all with the view of ascertaining the cause of pellagra so that knowing the cause you might apply the prevention?

Doctor KERR. Yes, sir; the object was to determine what the essential cause is. There are a great many things to be studied regarding pellagra yet, and we are still working on it as systematically as we have been at any time in the past. The actual cause within the body or the actual way the lack of diet works, we do not know, but that is the study that is going on and will continue until we throw fresh light on it.

Senator RANSDELL. But do you feel very much encouraged with the results you have obtained in the 20 years of effort?

Doctor KERR. I feel that is the way the Government should undertake it and never drop an investigation until some results have been obtained.

The past situation and the present may be compared to mining. In the old days when the cause of fermentation and the cause of tuberculosis was discovered, research should be compared with placer mining, work on the surface, but the deeper the view the more difficult the work becomes, and stamp mills have to be established and systematic working of the whole field must be carried on in order to get all that is of value within that field.

There are a great many problems that should be taken up in that way. The studies that are now going on in tuberculosis are of this character, and the projected studies of cancer are of this character, and no one knows how long it will take or how much effort it will require to arrive at a solution of the problems.

The studies of the causes of plague have been carried on over a period of years, but why the disease occurs in one section, one port, and why it does not occur in a neighboring port, is a subject for further investigation, and that kind of study will require the study of physicists and biologists to determine what are the factors promoting the continuance of the particular kind of flea that carries this disease in one port as compared with another.

In 1905 the expenditures on account of research were approximately $60,000 a year. Just before the war this amount had reached in the neighborhood of $550,000. The war rather severely affected the work and it was slowed down for a time. It is now going forward and expenditures for this purpose at the present time are in the neighborhood of $600,000 a year.

Senator RANSDELL. For scientific research?

Doctor KERR. For scientific research alone.

Senator RANSDELL. Of course those are all in regard to health problems?

Doctor KERR. All under the provisions of the acts that I cited in the previous session. The enlargement of the work will of course require additional facilities and additional funds.

Senator RANSDELL. You mean the enlargement carried in the bill that passed the Senate yesterday?

Doctor KERR. Yes, sir; the tangible value of past research has been enormous, and the intangible value can not be calculated at all. out of the discovery of the hookworm came the treatment and control of the disease throughout the country, and above all the stimulation of local and State health organizations which within 20 years have developed incidentally with the development of the public health service, and it is felt now that practically the whole of the regulatory measures regarding health are to be well taken care of in the future by State and local health authorities.

Senator RANSDELL. Do they cooperate well with your bureau?

Doctor KERR. The cooperation is splendid. The limitations that are placed upon the Federal Government in regulatory matters are well known. There are no such restrictions placed on research work, and I think one of the advantages of the enlargement of research

is the character of aid, and the best kind of aid that can be rendered to State and local health authorities on behalf of the public.

The work of the Public Health Service of course in research has to do with the prevention of disease. While we have a certain number of hospitals for the treatment of beneficiaries, our great field is the development of facts through research that will be helpful and effective in the prevention of disease. That is the natural growth of the public health work in the Federal Government.

Senator RANSDELL. I take it that that is without relation to any school of medicine or any line of thought. We are trying to find out what will prevent disease.

Doctor KERR. The school of medicine has nothing whatever to do with the studies of this kind and the relationship of the Public Health Service is very cordial toward different schools. In fact, our work does not encroach on them and any work that is done of a research character should be helpful to all schools of medicine.

Senator RANSDELL. You would gladly cooperate with them or have them cooperate with you in studies of any question which might be brought up by these various schools?

Doctor KERR. We feel that we have their good will and their cooperation. I think that it is not practicable for us to cooperate with every agency and every institution and every State or local health authority in everything they want to do. If you want to make progress you have got to determine the problems that are confronting you as a Federal health agency and make adequate plans for the study of those problems and secure the facilities, and go forward with them, getting such aid as you can from others. It should be the program of the Public Health Service, as the Federal health agency, to work out those problems, and it should not select problems that are local, and that can well be worked out by other agencies. In other words, the field is large enough for all, and in talking regarding the Federal research, I recognize that there are problems of research that the Federal Government is best adapted to take charge of, largely because of the geographical distribution, the mass character of the data to be collected, and the fact that it is better equipped or should be better equipped with scientists to undertake these studies.

Senator RANSDELL. Doctor, in what you have just said, I would like to ask you, in view of the research being conducted by various foundations and universities throughout the country, what reason you would advance for enlarged governmental activities in this field?

Doctor KERR. Well, I think the reason for an enlargement of Federal public health work is because of the large problems that are confronting, because of the difficulties, the complexities of these problems, and because of the returns to be obtained. I do not think that the Federal Government should undertake to do any work that would detract from any university or any foundation, and that some system of relationship should be established whereby each would know what the other is doing, and thereby apportion and by agreement and by acceptance apportion those things that ought to be done by the Federal Government, and that ought to be left to the universities and to the foundations. I have no fear myself of duplication. At present the desire to give forth to the world the new facts that may be discovered is so excellent that if a discovery is made in Tunis,

Algiers, it is only a matter of months before it is known throughout the world. If there is a relationship borne by the Federal Government with all these agencies, there should not be a duplication, and there is a certain amount of overlapping of work which is necessary. No single investigator, no single organization can make a pronouncement and say that it is the last word, because it all has to be confirmed. Pasteur's findings were the subject of serious discussion and debate and sometimes acrimonious debate for years in the Paris Academy of Medicine, and on his work was founded the science of bacteriology.

In the future some of the subjects to be taken up, of course, will relate to degenerative diseases. A previous speaker referred to that. The bulk of the work in the past has been the result of the development of bacteriology as a new science. In the future the investigations must go along several lines, and they must relate to degenerative diseases, arteriosclerosis, degenerative diseases of the kidneys, degenerative diseases of the bones, certain diseases of the blood. Chronic diseases of the blood are as little known to-day as they were years ago. It is these diseases which cause the death of members of society in their most productive years, and it is this type of disease the studies of which must be undertaken. In order to lay plans for the study of these diseases it will take a great deal of thought, and new problems will come up and new discoveries will be made in distant fields that will have a bearing on future studies in public health that we do npt realize at all to-day.

Senator RANSDELL. Is it not true that new diseases are developing too, diseases about which we knew nothing until recently anyhow?

Doctor KERR. There are a number of diseases that are being discovered. It was only 40 years ago that typhoid and typhus fever were separated by a Philadelphia physician. Fifteen years ago when we were combating plague on the Pacific coast, we discovered a bacillus in ground squirrels which we thought was just an interesting phenomena. The next appearance of that organism was discovered in connection with an outbreak of ophthalmia in Southern Indiana, and the next discovery of the disease was in Utah as the deer-fly disease, and it is proven that this disease exists in 34 States.

Senator RANSDELL. What is it called?

Doctor KERR. Tularemia. There are other diseases that have thrown a new light on the situation, and that will probably increase the importance and results of measures of prevention.

Senator RANSDELL. The discovery of this tularemia was due entirely to the work of your bureau?

Doctor KERR. So far as I know it was the first and only example of an organism being discovered before the disease which it caused was recognized, and that so far as we know, with the exception of one or two cases in Japan, it prevails only in the United States.

Senator RANSDELL. That is one thing that you have overcome that has contributed to the medical knowledge of the world, I take it?

Doctor KERR. Yes, sir; I think it is a very notable contribution.

Now the advantages of research and of systematic research, carried along broad lines, should be emphasized, and one could dilate on it, but I might mention the help that would be given from two different standpoints: One is to the health administrators to the country. Through research they have been able better to attack diphtheria. They have been able to attack scarlet fever, and every new fact that

can be brought out that has a practical application will now receive a welcome and an anxious audience, and that will enable the States to do less in the matter of research, in fact with the cooperation they can give to the Public Health Service and to the universities, their time can more and more be spent in the systematic enforcement of public-health laws and the reduction of morbidity and mortality.

We are constantly being reminded of the benefits that we have received and humanity has received through researches conducted in other countries, notably in Germany. There were reasons why their research was advanced, but the whole world received the benefits from them. With the commanding position that the United States now has from an economical and political standpoint, and with the influence that it must exert in the future, a very notable contribution and probably one of its assets will be the knowledge it can radiate as the result of this research.

A short time ago I attended an international conference at Habana where there were 40 countries represented, and the president of this conference in his inaugural address referred in very laudable language to the influence the United States had exerted on the health of Cuba. Whereas in the past Habana was the endemic center of yellow fever, that we all feared, now it is one of the cleanest cities in the Western Hemisphere, and I feel that no greater benefit could be conferred on other countries, and the Federal Government could have no greater asset than the knowledge that it extends to these countries, and there is provision for taking this knowledge to them, and they are very willing and anxious to accept it, as shown by the spirit that is manifested in the international sanitary conventions that are held in the American Republics every two years.

Senator Ransdell. What provisions have we now in the law for taking our knowledge to these foreign countries, and sending our scientists over to those countries to cooperate with them or to bring them to us?

Doctor Kerr. Under the law, a treaty provision is made for an international sanitary conference with the American Republics every two years, and the last sanitary treaty provided for the loan or the interchange of scientists to advise with other countries in health matters, and by means of the literature that circulates from one country to another, and these international conferences and individual representatives, the progress in public health research will soon be felt by the countries in the Western Hemisphere.

Senator Ransdell. Have you any fund now, Doctor, that would permit you to bring scientists here to work in your laboratory under your bureau?

Doctor Kerr. We have no funds, of course. Our funds can only be utilized for personal services in the making of appointments, which is occasionally done, but without special law, we occasionally extend the facilities of the hygienic laboratory to scientists who come and stay for a little time. Of course, that is a courtesy, without expense.

Senator Ransdell. You give them the privilege and they do not have to pay anything?

Doctor Kerr. It has been a help to us and to the scientists who have been there.

Senator Ransdell. If that could be enlarged and made to reach more, it would be helpful all around?

Doctor KERR. I should like to say that research laboratories of the Public Health Service extend their facilities so that they benefit scientists. Scientists can be given the facilities of the laboratory for the purpose of study and association, to live in the atmosphere that surrounds these laboratories, and be able to profit by it, whatever profit they can secure. I think it has been a great help in the past. The chief of the division of chemistry of the hygienic laboratory is internationally known, and the Rockefeller Foundation last year was instrumental in bringing about an exchange of scientists, among them a chemist from the University of London who came to the United States to stay three weeks and it resulted in his staying in the hygienic laboratory for several months. He was interested in an urgent fundamental piece of research that the chief of the division of chemistry was undertaking and was interested in taking this back to his University of London. That is one of the great advantages of an interchange of scientific men.

Senator RANSDELL. Now, doctor, in line with that, what would you think of the probable beneficial effects of the fellowships which are contemplated in this bill, both from the direct appropriations of Congress, and from the donations that we would receive from wealthy men?

Doctor KERR. I think the work of any institution, any great research institution, depends on the education and experience of its staff, and the tenure of office that is accorded to it, and one of the greatest problems in the conduct of research is the securing and keeping of scientific workers.

Senator RANSDELL. You mean the salaries are so small that it is hard to keep them, is that the idea?

Doctor KERR. The salaries have been small in the past and the field of research is, from a remunerative standpoint, outside the laboratory perhaps in which he has got his education, very small indeed. We have the need of men along narrow but very essential fields, that were we to discontinue would have great difficulty in securing positions. In other words, the work is not developed in other parts of the country, and there is no call for that kind of service.

I might cite one example. When we undertook the studies of pollution of streams in 1913, it was necessary to make special studies of plankton, which is the small vegetable life just above that of bacteria. We hunted all over the country and found a man. He has done excellent work through these years but if we had not needed his services, I do not know of a single other place in the country that he would have been able to go and engage in like research. Without it he would have obtained some teaching position, and he would have been lost to research; his contributions have been very notable.

Senator SACKETT. Is your hygienic laboratory allowed to accept donations of funds?

Doctor KERR. There is no provision in law for the acceptance of funds by the hygienic laboratory. The Public Health Service is authorized in a law passed many years ago to accept moneys on behalf of sailors for the maintenance of marine hospitals.

Senator SACKETT. Not for any research work?

Doctor KERR. No. In fact, it is not practicable to accept any money, even for traveling expenses, from an unofficial agency. From State and local health authorities we may accept pay for traveling expenses, and for services from State and local jurisdictions.

Senator RANSDELL. How do you feel personally about that provision of the bill authorizing the Secretary of the Treasury to accept donations for the general work to be carried on under this bill?

Doctor KERR. Of course, from the standpoint of a public health officer, deeply interested in the advancement of science, it seems to me it would be a good thing. The broad question of public policy is one with which—I may not answer it from that standpoint. Of course, there have been some precedents; you yourself, Mr. Chairman, have cited one, in the case of the Smithsonian Institution. I realize that any authorization of that kind would have to be surrounded with safeguards. Any gifts that might be tendered would have to be accepted unconditionally; they would have to relate to fundamental lines of investigation, and not to particular appliances and particular problems that might have a selfish background. They would have to be free and unconditional just as a gift for the Smithsonian Institution was, and they would have to be audited by the accounting officers of the Government just as the appropriations made by Congress.

Senator SACKETT. Ought that not to be included in this bill, that sort of provision?

Doctor KERR. I think, Mr. Chairman, that any bill which carried a provision of that kind should make it clear what should be done, because of course the subject of improving public health research should not be open to criticism or to abuses.

Senator RANSDELL. Now here is the way that section 2 reads:

> The Secretary of the Treasury is authorized to accept, unconditionally, on behalf of the United States, gifts by will or otherwise, for study, investigation, and research in the fundamental problems of the diseases of man and matters pertaining thereto. Any such gifts shall be held in trusts and shall be invested by the Secretary of the Treasury in securities of the United States, and the income thereof shall be administered by the Surgeon General for the purposes indicated in this act.

Then it goes on to authorize the Surgeon General to establish fellowships, and so on. I would be delighted if we could hedge that around any better. The spirit was to make the gifts unconditional, just as you have suggested, and be limited to health problems, and if there is any trouble about that word "fundamental" I am willing to keep it out and just say "problems of the diseases of man," because I wanted to be general, and if a man gives money, to give it without any strings whatever, tied to it, as Smithson did a hundred and fifty thousand dollars 100 years ago for the diffusion of knowledge among men. That was about the only string, just the diffusion of knowledge among men, and equally we want these gifts to be studies, investigation and research in the problems of the diseases of man and matters pertaining thereto.

Doctor KERR. I have thought of the possibilities of the acceptance of gifts. Of course, it would be wholly improper to accept a gift from some organization which had a special selfish interest to serve.

Senator RANSDELL. Surely.

Doctor KERR. If the principle is adopted, it should be unconditionally. They should be along broad lines, and it seems to me it

might be a very useful provision. I do not know what response there would be to it. I feel that while it may not be generally recognized, the safeguards surrounding the expenditure of public money from the standpoint, as far as it is expended by a division or a department, are so rigid that I would rather trust my money to expenditures in that way than with any other organization I know of. You can not get away with considerable wasteful expenditures for any considerable length of time.

Senator RANSDELL. Indeed you can not, and those gifts would be held in trust by the Secretary and invested in United States securities, and the income administered by the Surgeon General. I take it that would be surrounded by all the safeguards that could be furnished by Congress. That is the intention now, and if we can tighten up on it now I wish you would think about it and let us tighten up on it if we can, for that is certainly the spirit of it.

Doctor KERR. I think there is a greater recognition than ever before of the value of research. That is shown by the successive acts of Congress and the appropriations that are made, and it is simply a determination of the size and the amount of this work that it is proper for the Federal Government to do, the amount that there is to do, and that will continue to be presented for solution.

Senator RANSDELL. Let me ask you this question. If Congress should pass this bill and it should be administered in the spirit of the act, can you see any interference with the educational institutions of the country or with any of the scientific schools or branches now engaged in research, or would it not be helpful rather than otherwise?

Doctor KERR. The Federal Government should never be put in the position of doing anything to limit investigation and the advancement of knowledge by any university or foundation that may exist. It should be in touch with these, and should cooperate with them by advice and by other means, but it should certainly not deter any institution from enlarging its bequests, and the work that these institutions are able adequately to carry on the Federal Government should not undertake.

Senator RANSDELL. This bill does not contemplate educating men, I take it, but it contemplates taking men who have already received an education in other scientific institutions and carrying them on in what might be called a postgraduate course, if you will, in your own cooperative effort toward scientific research.

Doctor KERR. One of the great needs of the country at the present time is the development of postgraduate research workers. It is well known that a great many of our students throughout the country are self-educated, so to speak. A man may be wonderfully qualified and gifted along a certain line, but it is not a remunerative line and he would not follow that line. There should be some plan worked out by some agency whereby genius would be recognized. The greatest asset of this country is its brains.

Senator RANSDELL. And this bill would provide that agency, would it not? It seeks to do it.

Doctor KERR. It would seem to me as though those men who benefited by fellowships would be stimulated to go forward, but there is difficulty in acquiring professors in universities. There has been a great inflow and outflow to our institutions from universities.

Three of the professors of Harvard University were in the hygienic laboratory. The chief of the chemistry division went to another university, and that is what is going on all the time.

Senator RANSDELL. Is it not a fact that you lost those very able men because of the very meager salaries that you are able to pay? Suppose you had had funds and could have provided for them under this fellowship division. Could you not have kept them on?

Doctor KERR. We could have, but there is an advantage, within limits of this inflow and outflow.

I do not know that I have anything else to say unless there are some questions.

Senator RANSDELL. I want to ask one or two questions. Is there any likelihood that the service contemplated in this bill would encroach upon the authority of the States and municipalities? I think you covered that fairly well, but just make a little summary.

Doctor KERR. I think any investigations carried along legitimate lines of public-health problems would be helpful to the State and local health authorities, and of course, it is their province within the State to carry out regulatory and preventive measures.

Senator RANSDELL. So that it will be helpful rather than an encroachment and interference with them?

Doctor KERR. I think there is no danger of encroachment. That question is behind us.

Senator RANSDELL. They are cooperating absolutely with you?

Doctor KERR. Yes, sir.

Senator RANSDELL. Now tell me what, in your experience, are the greatest difficulties confronting the administration of research activities?

Doctor KERR. Well, the greatest difficulty from an administrative standpoint is the securing of adequately trained men, to retain their services, not because of the undesirability of the positions that we have, but because of the small outlook. A chemist who probably started out and was investigating public health fundamental research, is attracted to industrial research because of the opportunities, and the same applies to health officers. A man may be a very able health officer, but if he is a good doctor he can do much better from a financial standpoint from the practice of medicine than he can in health work. Notwithstanding that fact since 1911 there have been developed in this country full-time county health officers in over 400 counties, and it is quite a marvelous record of progress.

Senator SACKETT. It is more difficult to get them than it is to get the money?

Doctor KERR. That correctly states it, Senator Sackett. The difficulty with which we acquire money makes us more careful in its expenditure.

Senator RANSDELL. Then, Doctor, I think your difficulty would to some extent be overcome if your work could be enlarged as contemplated in this bill. Every bit of this is to be done under your bureau.

Doctor KERR. From the general standpoint, one of the great problems of the country as a whole is to make public health research effective, to make investigations in pure abstract terms, attractive. It has been difficult to educate health officers, to get enough to take positions that have already been established. The Rockefeller

Foundation has to train its own field workers and about two years or two and a half years ago the Surgeon General called a conference of scientific men throughout the country to come here at their own expense and discuss the education of health officers and research workers. Practically every university and foundation in the country was represented, and they all realized that it was one of the problems of the future. I do not know what we are going to do to make investigational work along abstract lines more attractive and more remunerative, but I feel sure that one of the greatest advantages to the country in the improvement of its internal condition and its relation to the foreign countries, would be the magnification of the importance of research, and give credit to the men who are willing to devote their lives to that kind of work. That is one of the great problems. Now, any reasonable aid by Government or by institutions that will bring that about will be of great advantage to the country as a whole.

Senator RANSDELL. I would like to state in that connection that what has been in my own mind with regard to this whole bill is to have our Government display a degree of liberality in making appropriations so that you can, when you find able scientists who are willing to work and to devote their lives to these investigations, pay sufficiently large salaries to attract them. I know that a great many of the salaries paid by the Government are not very attractive to many men. There are pure lovers of science like yourself, Doctor—you love your work, so that you probably have made a great many financial sacrifices in order to retain the place that you in my judgment honor so well, but a great many men are not that philanthropic or altruistic. They are enticed by larger salaries, and if the Government would make much larger appropriations than it has done in the past for this character of work, and if wealthy men would make large donations that I believe firmly they will make, then I think these positions, through the fellowships that we have spoken of here several times, would be much more attractive to the kind of scientists that you desire to have.

Doctor KERR. I do not know whether I have made any financial sacrifices, but I have taken great pleasure——

Senator RANSDELL (interrupting). You are too modest to admit it.

Doctor KERR (continuing). In my work, and it has been a great satisfaction to see the public-health work grow and see the benefits that have come out of it.

Senator SACKETT. May I ask a question or two before you stop? You have a certain nucleus now in the department of Public Health that is doing a certain amount of public work of this research character. Is it not the real object of the bill to enlarge, through giving a larger income, to enlarge the scope of the work you are doing, to extend its ramifications in various directions and to provide you with further facilities in the shape of buildings and laboratories around your present formula that you are working under, substantive law that you are working under, so as to enable you to accept gifts and to provide legislatively for the employment of certain fellows that can be sent here, there, or the other place, and is not that all that the bill seeks to do rather than create a new institution, to fill a want that is not filled by any of the present-day works of the Government?

Doctor KERR. The practical effect of the legislation would be to enlarge the work of the Public Health Service and to enable it to fulfill a larger field in public-health research.

Senator SACKETT. One reason I am asking that is because there is a prejudice about creating new institutions, and it is harder, legislatively, to get that through, and if it could be brought about through small and gradual growth of the facilities now at your hand, with these minor changes of accepting gifts and appointing fellows, it would seem that in the consideration of the bill it would have a better chance to get somewhere. But if there is some new nucleus needed which could only be created under a new substantive law——

Senator RANSDELL (interrupting). May I suggest to the Senator there that if he will look carefully at the bill he will see that the Secretary of the Treasury is authorized and directed to establish under the jurisdiction of his department and the administrative control of the Surgeon General of the Public Health Service this health institute. We do not seek to create any new service here. We ran up against that, Senator Sackett, a number of years ago—I had nothing to do with it—when there was a determined effort to create a department of health in the Federal Government, and it met with very much opposition, and did not have any success at all. If you will carefully examine all the terms of this bill you will see that it contemplates doing what you suggest, to enlarge the scope of the Public Health Service, to give it more money to operate with through its present agency. It does not create any new agency.

Senator SACKETT. I thought it did.

Senator RANSDELL. It authorizes the establishment of an institute of health. Perhaps it could operate just as well through the hygienic laboratory.

Senator SACKETT. That is what I wanted to know, whether the institution we have now, sufficiently enlarged, could accomplish the result, rather than to go before Congress and ask that the Congress should create a new institution like the Smithsonian or some of those which would be appended as an independent and separate institution to work already undertaken, or whether we should simply enlarge the facilities of the present institution and go ahead.

Doctor KERR. I am not at liberty, of course, to advocate any particular provision of this bill. I may say, however, that as a result of my association with the department for 20 years, I would like to see adequate provision made whereby the Government can stand out in the front rank with all other Governments, and not have to refer in the next 10, 15, or 25 or 50 years as having outstripped us.

Senator SACKETT. I get your thought there, but here is what I am trying to get at. Do you feel that this research work would become a part of the Hygienic Laboratory operation if you had sufficient funds?

Doctor KERR. I have always hoped and believed, Senator, that the Hygienic Laboratory should and could be developed into an organization that would meet the needs, and that would stand out in comparison with any other institution in the world.

Senator SACKETT. You would not feel that it was necessary to create an institute of scientific research, or whatever it is called, of which the Hygienic Laboratory would become a part?

Doctor KERR. Well, the road you take toward the objects to be accomplished of course is for the decision of Congress. My effort has been spent in pushing the work and developing the Hygienic Laboratory as a scientific institution.

Senator SACKETT. If you could go right on and get more funds, you could accomplish what you want to do?

Doctor KERR. Whether there would be developed in the institution an institute of health of as large size as Congress and the country as a whole wants is a matter for Congress to decide. I think the great need is for the representatives of the public to accept the principle that there is a great field to be filled, and that it needs to be adequately supported.

Senator SACKETT. You have a law under which you operate. The law would be broad enough to allow you to do all of these things if you had the money to do with, would it not?

Doctor KERR. The laboratory is not restricted in basic law as to researches which it can take up. There will be necessarily law required for the improvement of the organization from time to time.

Senator SACKETT. That is purely monetary.

Doctor KERR. Any institution in order to live and grow must be adequately financed.

Senator RANSDELL. Doctor, do you have anything else that you want to say?

Doctor KERR. That is all.

Senator RANSDELL. I thank you very much.

Doctor Stimson, would you not like to say something?

STATEMENT OF DR. A. M. STIMSON, ASSISTANT SURGEON GENERAL, UNITED STATES PUBLIC HEALTH SERVICE, IN CHARGE OF THE DIVISION OF SCIENTIFIC RESEARCH

Doctor STIMSON. Mr. Chairman and members of the committee, so much has been said here about the value of scientific research along public-health lines, about the need for increased activity in those lines, and about the Public Health Service, that it leaves me very little to say, I am afraid. I would like, however, to make just one statement, perhaps not to the members of the committee, but certainly to those who will consider this bill later. Certain of those who may discuss the bill later on may inquire as to whether the Public Health Service as it now exists is equipped to undertake this large responsibility which you are urging upon it, or which you are making available to it. I think it is not generally recognized what a considerable research institution exists now in the Public Health Service, and I would like to say just a few words on that.

Senator RANSDELL. I would be very glad, Doctor, if you would discuss any branch that you feel would be helpful to us.

Doctor STIMSON. At the present time we have some 325 persons on the pay roll who devote their entire time to scientific research in the Public Health Service. About 120 of those are at the hygienic laboratory. The remainder are at other laboratories which we have at various field investigating stations throughout the country. The subjects which we are investigating at the present time do not begin to cover the problems of public health or of preventive medicine. They do all they can, but they do not nearly cover the field. Every

major topic of public health has been considered at one time or another by the Public Health Service, and some contributions made to it. But we realize as much as anybody can that what remains to be learned to-day and to be applied is vastly greater than what has been learned.

The impression has been given, I think, by previous witnesses here that we are indebted to Europe for almost all of the knowledge we have with regard to preventive medicine and public health. Perhaps in a way that is true. Before the Public Health Service engaged in any research work, the science of bacteriology had progressed enough to discover the causes of a number of very important diseases. But the application of that knowledge is still very incomplete. We have known for many years that tuberculosis was caused by the tubercle bacillus, but just now we see that there is a tremendous amount of work to be done on it before it can be applied to the prevention of the disease in an ideal way. We do apply a great deal, but ideally there is much to be done.

Now, in this matter of applying knowledge, certainly America has nothing to be ashamed of, and we believe that the Public Health Service has contributed very largely and significantly to the actual practical measures which are to be employed in preventing disease and encouraging health.

Just in the matter of what has been done by the Public Health Service I might mention one or two outstanding things. Take the subject of epidemiology. That is a method of approaching disease which has not been employed very extensively anywhere yet, but I think more particularly in the United States than elsewhere. Doctor Carter by a purely epidemiological study, first showed that yellow fever must be due to an external parasite, having a definite period of incubation, and this knowledge was demonstrated be to entirely true by the classic experiment made by the Army. Then the epidemiological study of typhoid that has been referred to by Doctor Kerr, I think, for the first time showed the method of approach to this disease—it involved laboratory methods—and it has been very profitably carried on in this country just as well, and I think better, in many States, than in any European country.

Doctor Kerr spoke of the question of pellagra, and I would like to emphasize the fact that there is a serious disease which afflicted the people of Europe, which they had made a study of for centuries, without success, but which American genius has succeeded in solving.

So we are not entirely indebted to Europe for all of our public health research.

In the case of malaria—and it is just as prevalent in Europe, and they are endeavoring to cope with it there—we have made far more rapid progress in the control if it in this country than Europe has done, and the American methods, originating in the Public Health service, are beginning to be used in Italy in their study of malaria.

On another question, I think we are ahead of the game, and that is that of industrial disease, and the Public Health Service has been active in industrial hygiene. Its activity has been of a purely investigate and research nature, and it goes into the various hazards to which 40,000,000 people in this country are exposed. We can not cover that entire field, but here and there at what seem to be the most

important places, we do study what is contributing to the sparing of life in those particular districts and from those particular hazards.

Now in the matter of cooperation with existing agencies, I would like to say that the Public Health Service is experienced. We have from time to time conferences called by the Surgeon General to solve a great number of public-health probelms. A couple of years ago the question of the possible danger of introducing on a large scale a new motor fluid came up very strongly, and the Surgeon General of the Public Health Service then called a conference of the most able representatives in the country whose knowledge would have a bearing upon this, and within the period of time which now seems to have been incredibly short, a complicated investigation was carried through, an investigation involving a large number of trained medical men to make medical examinations and a large number of microscopists to make microscopic examinations of blood, a large number of chemists to work by chemical tests in connection with the others, and finally a group of experts to pass on the whole investigation and bring it together and to report. Now, that shows that the Public Health Service is accustomed to cooperation and to organization of research work, and if anybody considering this bill should desire information on points of that kind, I should like to have something in the record to show that if an enlargement of the possibilities of the Public Health Service is intended by one means or another, we have the nucleus of a very well developed organization already existing, which would be worthy of such enlargement and able to carry on successfully any reasonable increase of work which was allotted to it.

Senator Ransdell. Doctor, you spoke about having a certain number of your scientists working in the hygienic laboratory. Where are the others operating?

Doctor Stimson. We have a large building devoted entirely to laboratory purposes at Cincinnati. That is for the study of stream pollution, and city and municipal wastes of various kinds which pollute streams. We have a considerable number of workers there. We have there chemists, bacteriologists and planktonologists, and men equipped with the necessary amount of mathematics to bring this sort of thing together. We have a small laboratory at Greenwood, Miss., for the study of malaria. Then we have a branch laboratory at New York for the study of pneumonia, and what they are doing there is to take these serums, vaccines, and preparations that have been developed and made available for study and to determine what they do on the patient, because we have a large number of pneumonia patients there.

Senator Sackett. Is not that what the Rockefeller people are doing too?

Doctor Stimson. They may be studying a preparation that they are interested in, but after the preparation is brought out and perhaps put on the market, that is where we have a chance to compare it with other preparations.

Senator Sackett. Do not they compare it with other preparations?

Doctor Stimson. I do not think they would be so likely to do that as to work up their own preparations. They might not have the facilities for that. I am unable to say that they do not do so. They have an equal opportunity for studying these things. We are able to take alternate cases of pneumonia and treat one with this prepara-

tion and another with another accepted medical treatment, and compare results.

Senator RANSDELL. Your service does collaborate very fully, and I think very effectively with the State public health service, does it not, and with the county work in many instances?

Doctor STIMSON. Oh, yes; we cooperate also with the Rockefeller Institute and many other existing creditable research organizations which desire cooperation or with which we desire to cooperate and have the facilities for cooperating with.

You asked me where the rest of the people are. Many are out at small temporary stations in the field in various parts of the country, studying different problems.

Senator RANSDELL. You have one in my own State for studying malaria. I know personally of that.

Doctor STIMSON. And we have, as you well know, a laboratory in Honolulu for the study of leprosy. Doctor Kerr referred to our studies in leprosy.

Senator RANSDELL. And you are conducting a leprosarium in my State. Doctor Denny hoped to turn out 12 cases cured this year.

Doctor STIMSON. Doctor Denny is also doing some research work, but it has not happened to come up in my division.

Senator RANSDELL. He is doing a very extensive research work in that awful disease of leprosy, is he not?

Doctor STIMSON. Yes. We have a small laboratory in Missouri for the study of trachoma, that eye disease which has been so devastating, and in connection with leprosy and epidemiological studies among the mountaineers. I am just referring to these as samples. If I were to keep on telling you of our activites, it would reach into a long statement.

Senator RANSDELL. Do you see any conflict in what is contemplated in this bill to be carried out under the auspices of your department, and other work that is done by States and municipalities or institutions of any kind?

Doctor STIMSON. No, sir; I see no conflict.

Senator RANSDELL. No conflict?

Doctor STIMSON. No conflict.

Senator RANSDELL. But helpful cooperation is what is contemplated as you understand the bill?

Doctor STIMSON. Yes, sir; I understand it that way. There is no conflict at present, and merely by a change of activities that eixst in the Federal Government at the present time I do not think you would introduce an element of conflict.

Senator RANSDELL. Give us your full name and position.

STATEMENT OF DR. ARTHUR T. McCORMACK, STATE HEALTH OFFICER OF KENTUCKY

Doctor MCCORMACK. Mr. Chairman and gentlemen, my name is Arthur T. McCormack. I am State health officer of Kentucky. I have had now nearly 50 years of life in a State health department, 30 years of which has been as an administrative officer. I can, therefore, look back to the day of the creation of the State Health Department of Kentucky in 1878, when we knew very little about the scientific facts relative to disease. Our board was created as the

result of the recurring invasions of yellow fever throughout the South, where it was then endemic. Here yellow fever continued, year by year, to cause more economic and industrial destruction, entirely aside from the question of disease and death, than the recent flood, which has been so much more terrible than any other phsyical disaster that we have ever contemplated. Yet we had become so accustomed to that sort of thing throughout the years that we hardly realized that it was possible to be relieved from its ravages. In the creation of the State Health Department of Kentucky we were authorized to mobilize the militia; to suspend all ordinary intercourse in order to prevent the ravages of disease that we now know from scientific research was spread and caused by a definite insect, and, therefore, to be perfectly controllable. There was no reason at that time for either the enormous destruction caused by the disease or for the tremendously expensive and inefficient remedies that we were using because of our lack of knowledge of the subject.

From that analogy I think we can get the whole picture of what this means. We have developed very slowly because of the perfectly natural jealousy of those in authority, in constructive authority, in the country and in the world. We have developed very slowly our recognition of national responsibility for the prevention and control of disease. But within recent years that growth has been so rapid, it has called into collaboration so many branches of science, that the nations of the world have been forced to realize that this is for each of them a national responsibility.

Now just as an example, since the formation of our Government we have realized, as intelligent people would be compelled to, that trachoma is a contagious disease of the eyes which has devastated Egypt, Brazil, and China, causing such enormous destruction of usefulness of their population. Realizing that this was one of the major health problems, from the earliest days the Government has made provision against the introduction into this country of people who have the disease; and yet, within our own domain, we were developing nests of this disease from which it was gradually spreading to other sections of the United States. We had in my State alone probably 10 times as many cases as have been kept out for a hundred years by the operation of our laws. A surgeon of the Public Health Service, at our invitation, came down there and rode horseback and walked through the mountains where he found children hiding under the bed when the door was opened because of the frightful pain caused by the sunlight. These afflicted ones were unable to see the beauties of their surroundings. They did not know the flowers of the hills, they were unable to go to school, unable to make any economic progress, but were gradually filling our institutions and our poorhouses. This man came along and found those cases and made us cognizant of the size of the economic problem, when he demonstrated to us that there were 60,000 of our citizens afflicted with this disease. In one small county he had found 90 people totally blind from it. He found in our State institution for the blind that one half of the blindness was caused by this disease. He devised a simple plan, involving practical application of known scientific methods, to use there very quickly, and we have been practically freed from the ravages of this disease since 1912. Since Doctor McMullen began his operations, in one county where more than

half of the people suffered from this disease, and with very little expense, trachoma has been entirely wiped out and, since that time, there has not been a single case of blindness in that county. Formerly in our institutions most of the blindness was due to this disease; since that time none of it has been due to trachoma.

In so far as we are able, by the application of knowledge that we either already have or that can be secured by careful study, in so far we are able to realize the enormously increasing burden that is coming upon the people of the country by caring for those unfitted by this disease. In so far as we are able to keep men and women producing, rather than have them, during the latter years of their lives, invalids, and, therefore, not contributing to the national life, we are making a real investment in securing this knowledge.

Just recently in Kentucky, as in your State and in the entire Mississippi Valley, we have had the ravages of this terrible flood. Following each of the preceding disasters, we had had an equal disaster in the spread of disease. This year, for the first time, due to the application of knowledge secured, in many instances, by almost unknown individuals working in little cells in the laboratories, methods that they had devised and that had been sent from the central agencies of the Federal Public Health Service down into the administrative field, we were able to have not only no epidemic of intestinal diseases in that section, but we actually had far less disease, because we were able to secure the funds and to apply the means for their prevention, than we had in the surrounding counties where they had no flood.

Senator RANSDELL. That was the concentrated effort of the Public Health Service and the local people?

Doctor MCCORMACK. Exactly. There was a natural feeling—we all had it, particularly in the South, but it has been active in every part of the country from time to time—the fear of the encroachment of Federal authority on the State and local authority. In the Public Health Service that anxiety has long passed. There is the finest spirit of cooperation between the Public Health Service and the State and local boards of health. We have had the cooperation of the Public Health Service for many years in every way. Without the slightest anxiety we lay our difficulties in Kentucky, or in Louisiana (where you have had for anumber of years the service of one of the most distinguished health officers, Dr. Oscar Dowling), before the scientists of the Public Health Service and they have come to us as consultants and advisers and given us the benefit of their knowledge on the subject. They do the research work, study, and give us the advice and assistance that we are so frequently in need of.

As an example, just looking at the administrative side of the picture, during the last year we have had reported from almost half of the counties of the State cases of tuleremia, a disease that we never knew existed. All those cases had heretofore been diagnosed as typhoid fever or tuberculosis. They had the symptoms of one or the other, and it was clarified for us by the scientific research of a man whose name is hardly mentioned, and yet I am satisfied on that great record book up there his name will be in letters like those of Abou Ben Adhem because of the service he did for his fellow men. We were able to prevent the enormous sick rate apparently from typhoid fever by the application of simple means that had been overlooked for all these years. In the same way we had an epidemic of undulant fever. That

was recognized almost immediately and the proper steps were taken for its prevention. During the last summer, following this flood, we were threatened with diseases which would have left in their wake not only death and crippled children, who would have gone through their lives handicapped, and this was prevented by simple administrative measures devised after similar epidemics in other States by the Public Health Service.

A few years ago, during the war, I happened to be stationed in the office of the Surgeon General of the Army here. There was a consultation at that time between the members of the Cabinet in regard to the consolidation of all the health agencies of the Government, and I recall just one question and answer that I think are particularly applicable here. General Gorgas and Doctor Welch, the great laboratory worker, one of the greatest of all of our leaders, from Johns Hopkins, were present, and Doctor Welch said, "In your plan for these things, what will be done with the hygienic laboratory as it now exists?" And I can remember and always will remember the sweet smile that spread over General Gorgas's face as, with his dreamy eyes he looked forward to what should be accomplished and said:

I would always preserve that splendid little building and would make it the gateway at the entrance to a great national health institute that would be developed so that the numerous scientists there concentrating on all our problems might know how much had been accomplished in that little building in spite of the handicap of its smallness and the penury of the citizenship that had failed to realize its real needs.

Senator RANSDELL. He contemplated a great institution?

Doctor MCCORMACK. Yes, exactly. The application of the things largely discovered by these gentlemen under those handicaps enabled us to send an army of 4,000,000 into the field, enabling our allies to win the war, because they did not have in addition to fighting the most ingenious and the best organized foe that mankind has ever met and conquered, because in addition to that enemy we did not have to fight every disease that every army heretofore mobilized has had to fight. We sent forward not only the healthiest men that ever have gone forward into an army, but when they came back they were healthier than when they went in, for the first time in history, and that happened largely because of these modest men who, themselves, have never asked for anything. They have been entirely too modest, because, from the very nature of their work, it is almost necessary in the development of the kind of psychology that enables them to accomplish their results, they do not come before legislative bodies and talk about what they have done. They are modest in talking before the different scientific bodies, but those who have been their beneficiaries and have transmitted their discoveries into practical application to the population, realize our indebtedness to them, and we realize fully that we are authorized to speak for the people who are now living who would otherwise be dead or diseased and disabled, the debt we all owe them.

You realize, I know, because I know of your contribution to the consideration of this subject in your long and distinguished service in the Senate. You realize that at the time you came into the Senate the average age of life in your State and mine was about 30 years. In your State and mine now the average citizen lives to be 56 or 57 years of age. When I first became interested as a boy, under my

father's tutelage, in the public health, the death rate in my State was more than 30. The death rate now is somewhat more than 11. Those changes have been brought about almost wholly because in our schools we have been taught to apply the knowledge for the prevention of disease and the extension of life that has been developed in the meager laboratories that this Nation has provided for its scientists. The day has come for a realization of our indebtedness to these laboratory workers by having them housed in places where it is easier for them to accomplish their purposes. They ought to be given every facility in the world. And in addition to the other great benefits given to them, all of us interested in this work should be pooling our knowledge of the problems yet undetermined so that we who are in the field applying the results of research directly to the people and they who are busy with new discoveries can make even greater contributions in the future than we have ever done in the past.

Senator RANSDELL. What do you think of this bill, Doctor?

Doctor MCCORMACK. I think the principle of this bill is excellent. I had the opportunity of hearing it discussed very extensively. As chairman of the committee of the American Medical Association on public health at its session last year, I heard all of these possibilities and merits and the hopes of those who are animated by it discussed, and heard physicians enheartened by its very introduction. I remember particularly one thing that I think you will be interested in hearing. Dr. Charlie Mayo, the great surgeon, in talking about the development of the thing, said that we had merely started in what we had to do in our public health work. He was discussing particularly the matter of stones in the kidney and gall bladder, the various degenerative diseases of the heart, referring to them as preventable diseases, and yet we have barely begun to get an inkling of the methods by which they will be prevented. We are on the eve of discoveries along those lines that will be of far greater moment than any that have yet been made. One thing that we need is the proper facilities provided by such legislation as is suggested by this bill.

Senator RANSDELL. Would this legislation, do you believe, interfere with other institutions?

Doctor MCCORMACK. It would help them. The Public Health Service is helping them. I happened to drop in the other day at a conference in the Surgeon General's office, where various investigators were assembled who represent organizations that are making a study for the prevention of cancer. At this time they were gathered around one table, just as this committee is considering this matter, and they were there considering the various steps to be taken with a view of correlation and saving the waste of duplication. If in that same way they could be gathered together there and could demonstrate over a period of months, as is contemplated in this bill, the steps that have been taken and should be taken, how valuable it would be to the man just starting in that same field who is going to do constructive work from that point on, and not have to spend the best years of his life in learning what has already been done by the several institutions.

There is another phase of that problem that is of even greater moment. We have a great many universities in this country, a great many of them with large wealth, large endowments, that are making

very important contributions to scientific knowledge through their research departments, and those that are wealthy should do that. And yet because of the demand for knowledge that we know is almost within our grasp, and yet hardly there, institutions like the University of Louisville, with its meager funds, find the scientists using a large part of these funds in research work that ought to be spent in teaching. We ought to be teaching more doctors to practice medicine. We ought to have larger facilities for teaching the healing art in this country, and the money for this purely scientific research ought not to be charged to the medical student as a part of his education. It means, when that is done, the tax is put on the one who is least able to afford it. It ought to be done by the people who are to be its beneficiaries, that is the whole people of the United States, and not merely by the individual.

You take the American Pharmaceutical Society, represented here, or the American Chemical Society, or the American Medical Association, or any of the various organizations now in this country doing research work, how they are spending their meager funds—and they are always meager—for this purpose which the Congress and the Nation can alone adequately finance and encourage. The application of the knowledge should be their job and the great foundations and the great universities and the Government itself, above all the Government, have the duty of discovering and making common knowledge of these facts for the benefit of humanity that we so greatly need.

When we contemplate what has been done for agriculture in this country and in our civic life, in the development of our roads and mines and factories, and in every material thing, we have accomplished wonderful results. When we consider the small proportion of our wealth expended therefor we have also accomplished wonderful. results in our public-health work. Yet the results of public-health work are very meager in proportion to the knowledge we ought to have in that great territory of knowledge. We know it is there but have never been able to map it because we have not the money and the trained personnel to supply all those great fields.

Senator Ransdell. Doctor, what would be the result, in your judgment, of the general cooperation which is contemplated in this bill, the bringing together of the scientists of every branch? Should that result very well indeed?

Doctor McCormack. I think it is the essential part of the bill. It is the essential thing in the development of science. When you think of what the chemists have found, what the engineers have discovered in regard to environmental causes of diseases, what the chemists have found during years of experiment that will be the exact antidote for poison developed from bacteria and from germs in our bodies, when you think of the wonderful pharmaceutical investigations that have been made and the research work that has been done, when you go into the laboratories as I have had the privilege of doing and see these men almost starving in order to secure their results, frequently actually doing so, and see how much is being accomplished, the wonder is not that they not accomplished more; the wonder is that their devotion has enabled them to accomplish so much. Encouraged by this Government, the greatest on earth, it absolutely startles one's imagination to contemplate the

resulting benefits to humanity that can be accomplished. We are trying to do this sort of thing, each one of us, in our States, and civilization is going to be continually benefited.

There are going to be new institutions and we are going to be supporting them. We are going to wisely prepare plans and methods by which the investigators in those institutions will be retained, and there will be happier and longer-lived citizens, making the world a better place to live in. It is that thought that this bill is working on, and we feel encouraged by the fact that you have thought of such a thing as this, and to believe that its fruition is possible, and it fills us all with a tremendous debt of gratitude for your having taken up the subject and to Congress for contemplating its enactment.

Senator RANSDELL. Thank you very much for that, Doctor. This institute, if established in the big way in which it is conceived, would furnish splendid leadership for all the State boards of health and the medical and other health institutions throughout the country?

Doctor MCCORMACK. Exactly. It is just the sort of thing that we need to have.

Senator RANSDELL. We look to Washington for nearly all kinds of leadership.

Doctor MCCORMACK. Yes. We have an excellent institution here, but such an institution as here proposed will develop the brains and leadership that will lead us in the right direction a great deal further.

Senator RANSDELL. It has been my idea that this city of Washington should be a clearing house for health for all mankind, and I was sorry to hear what foreign countries had done in comparison with what we have done. I did not realize it until Doctor Hunt brought it out I should like to get in the van instead of being in the rear.

Doctor MCCORMACK. As a matter of fact, when you consider the solution of many of our problems, such as malaria and yellow fever, which has been wiped out by a group of men living in a little hut in a camp in Cuba, when you think of the devoted work of Gorgas and Carter and others and their contribution to the world, although the original discovery was made by an English Army surgeon and by the Italians in the swamps around Rome, yet the application by our people of Yankee ingenuity has made it successful. It has been American ingenuity that has applied science to the curing of trachoma. If we can have the physical facilities and the psychological environments in which to work and develop the research side of it, I think we can develop the patience to do it.

Senator RANSDELL. Do not overlook hookworm. Are we not entitled to the credit for that?

Doctor MCCORMACK. Yes; we are entitled to the credit for that, because it had been discovered in Italy 150 years before we had begun to think of it, yet when the possibilities of relief were pointed out to Mr. Rockefeller, the money was forthcoming, and with the cooperation of the States of the South we have practically eliminated what was contributing to the inefficiency of southern districts.

Senator RANSDELL. You have mentioned the ravages of the flood. Suppose the benefits that accrued from the splendid cooperative work of the Public Health Service and the State boards of health and the local boards, suppose that could be translated into money, the actual saving which resulted from the work of all those

organizations, you would not be able to guess how many millions they have saved.

Doctor McCormack. I have said that frequently and have thought about it many times. Notwithstanding, the enormous destructive damage to commercial and other life as the result of that flood, if there had been no other result, than the increased knowledge of administrative health measures, we will not pay as much for flood control as we will save in dollars and cents in the conserving of human lives because of the much better administrative measures that have been developed.

Senator Ransdell. You stated, and I have heard from other sources, that the health was actually better following the flood because of the splendid efforts that were made.

Doctor McCormack. We had 128,000 people in our flooded area in Kentucky when Mr. Hoover was first there as the national flood director. He told us he would make available for us as much money as was necessary for tent hospitals, as much as was necessary to take care of typhoid fever patients, and yet we never had to spend a cent. We did not have a half dozen cases in the whole area. We had less than a tenth as much typhoid as in each of the preceding 18 years in the whole flood area.

Senator Ransdell. You would have had it except for the cooperative effort?

Doctor McCormack. Absolutely.

Senator Ransdell. Doctor, we are very much obliged to you.

Doctor Herty. Will you give a few moments to a member of the Pharmaceutical Association?

Senator Ransdell. State your name, please.

STATEMENT OF E. F. KELLY, SECRETARY OF THE AMERICAN PHARMACEUTICAL ASSOCIATION, BALTIMORE, MD.

Mr. Kelly. Mr. Chairman, Doctor Herty yesterday submitted here for insertion in the record a telegram from the president of our association stating that I would be asked to come over here and express our interest in this legislation and our support of it, and I am very happy to do so.

Pharmacy for hundreds of years has been interested in the production and development of remedial agents, and of course has cooperated in the work very closely with the medical professions and other professions interested in public health. I make the statement now in order to illustrate the point why we are particularly interested in this legislation. We want to cooperate with our sister profession to enable the Government so far as possible to cooperate in this wonderful work contemplated in this legislation.

Now, Dr. Treat Johnson, in his remarks the other day, referrred to the cooperation which he had had from two large manufacturing pharmaceutical concerns. I think that illustrates very forcibly what the pharmaceutical profession has been able to contribute to this kind of work, and our very deep interest in it.

I feel that the ground has been covered so completely by those who have spoken that there is not very much that I can add to it. But we want to emphasize it.

I would like to refer particularly to the cooperation which we have had in our work from the hygienic laboratory. In many establishments where medicines are made and standardized we have been able to secure cooperation from the hygienic laboratory that has been of tremendous assistance in establishing standards of medicine. I doubt if those who have to do with public health know how necessary it is to have proper medicine in the control and prevention of disease, and to a certain extent that applies to preventive medicine. We have been helped so materially by having these standards and investigational work along the line of standards done by the hygienic laboratory that I feel I should emphasize its value and our desire to assist in expanding this important line of work.

Our establishments, Senator, try to do research work as far as possible, and as far as possible our institutions are doing it just as far as possible. Our colleges and institutions all have possibilities along this line, but it is impossible for us to go beyond a certain point. Even large business concerns, such as those referred to the other day are only able to go a certain distance in this direction. Now we are very hopeful, and will be very happy, if the Government could provide these facilities for pure research which are beyond the reasonable activities of these agencies. Our colleges are handicapped in just the same way as these men are, and our president wanted me to bring out this point to you and to assure you of the interest of our association in this line of work.

There is one other point that I would like to mention in order to illustrate this situation. A few years ago we established what was known as the National Conference of Pharmaceutical Research and endeavored to learn of the research work and workers along this line in the United States. We have been able to do that to a very gratifying extent, but as a result of that we have realized that we have only collected information from the northern group, and that now we have to step forward and correlate with the work of other groups, and I can not conceive of any better way for this research work to be correlated and developed than along the lines outlined here. Just how it is to be done, so far as details are concerned, our association is not concerned with. The great benefit will not be so much to our people directly as it is to those people that we serve in the manufacture and distribution of pharmaceutical products. That is as far as I care to take your time.

Senator RANSDELL. Thank you very much.

Now, Doctor Herty, you had only started your testimony. Would you like to go on?

Doctor HERTY. I do not know. I will leave it entirely in your hands. I would like to have some things at least put into the record.

Senator RANSDELL. You may put them in, with such statements as you want to make.

STATEMENT OF CHARLES H. HERTY, ADVISER OF THE CHEMICAL FOUNDATION, NEW YORK CITY—Resumed

Doctor HERTY. Mr. Chairman, in continuation of my testimony I want to say I suppose it is the privilege of all people to change their minds as they get new light. Some six years ago I was chairman of a committee of which Doctor Johnson, who testified, and Doctor

Hunt, who testified yesterday, were members, and we prepared a report involving the question of the creation of a chemical institute, an institute for chemomedical research. In that report we made the statement that we felt that such an institution should not be under Government auspices. I will read you this because it might be brought up some day and I might be asked, "Why are you talking this way?" Let me read this paragraph [reading]:

> But the latter war was carried out under Government control, and since all are subject to disease it may be argued that the prosecution of similar work in times of peace should be a government undertaking, just as fire control is a common tax upon the inhabitants of a municipality. It has been contrary, however, to the practice of our legislators to provide means for carrying on fundamental scientific research in government laboratories. Such laboratories exist for the enforcement of laws or for other utilitarian purposes rather than for the prosecution of fundamental research. In peace the desire is to get away from Government control.

That was written before I had experience in 1922 in trying to present to the Members of the Senate the question of the necessity of preserving our organic chemical industry in this country. As the result of what I have learned of the wonderful work done by the Hygienic Laboratory of this Government, and the beautiful results obtained with the limited facilities at its disposal, I have changed my mind completely, and I feel that the Government should lead in this matter.

Senator RANSDELL. You think the agency to lead should be the Public Health Service?

Doctor HERTY. Yes; absolutely.

Senator SACKETT. The change of opinion has nothing to do with the difficulty of getting the money by privately owned institutions?

Doctor HERTY. No; not at all, because this pamphlet has been largely instrumental in bringing about great development since that time. We have letters in the chemical foundation from those who have received these pamphlets—we distributed half a million copies of it—letters showing the effect of this report, on the development of this kind of work. Now I have had the privilege in the last few months in connection with my work—I am connected entirely with the educational work of the chemical foundation—of addressing a great many audiences of all types in all sections of our country about this matter, and that is what I feel I would like you gentlemen on the committee to know, to be impressed as I was, at the absolutely sympathetic, unanimous response of every audience I have talked to in regard to the matter covered by this bill. It is only a question of their understanding it, of their getting to know about it, and I think that the members can feel, from the types of people I have talked to, which range from business men to college students, scientific men, in Boston, Indianapolis, Richmond, and other places, that this country will be solidly back of the step which its representatives take in this matter, if they should enact this legislation.

Now, I would like to see go into the record a report which has not been referred to here in these hearings, a report issued by the Surgeon General not long ago, because I want to interpret that report in the figures I used in scribbling on my desk the other day. It was a very interesting report, and I would like to suggest, Mr. Chairman, that you print it. It was published in the United States Daily. This report is by Surgeon General Cumming of the Public Health Service,

and it is a report of a typical small town, giving every case of sickness recorded.

The report follows:

Public health in a given community depends upon the personal health of each individual. Health officials generally have recognized that, although a great deal is accomplished by means that deal with community conditions, yet the individual is the foundation upon which the public health is built.

In order to know what diseases must be guarded against it must first be known what diseases are present. Not only the causes of death but the causes of ill health as well are of great importance to health officers and physicians in their scientific searching for causes and conditions in their preventive work. Of far greater importance than death rates and life table expression is a view of the health situation depicted by physcial impairments as revealed by competent medical examinations and by morbid conditions as ascertained by adequate records of sickness.

With this thought in mind a study was conducted by the Public Health Service extending over more than two years in a city regarded as a typical American small city in one of the Eastern States. The information obtained through this study is of great interest to the general public, as it shows clearly what diseases are most prevalent in the general population.

The city in which these studies were conducted may be said to be typical of many other cities of its size in the eastern section of the United States. The principal object of this study was a record of illnesses that were experienced by a population group composed of persons of all ages and both sexes, and in no remarkable respect unusual.

The records of illnesses obtained were of illnesses as reported to experienced investigators. The reports were made by the household informant, usually the wife, either the sickness as experienced by herself or as she observed it in her family.

The rate of sickness from colds and bronchitis was the highest, being annually 418.6 per 1,000 persons. Influenzia and grippe came second, with a rate of 143.2 per 1,000; diseases of the digestive system were 96.5 per 1,000; tonsilitis and sore throat, 65.7; confinement and other puerperal causes, 46.9; diseases of the nervous system, including headaches, 44.1; accidents and other external causes, 39.5; measles, 34.2; whooping cough, 22.6; rheumatism and lumbago, 21.8; heart and other circulatory diseases, 18.3.

The list contains 10 or 11 more items and concludes with hay fever and asthma, which is shown to have caused 5.8 cases of sickness each year per 1,000 persons.

ILLNESS RECORDED MORE THAN TRIVIAL

From this study fairly accurate records of real illnesses were secured. As a matter of fact less than 5 per cent of the illnesses of exactly stated duration were recorded as one day or less in duration; nearly 80 per cent were three days or longer, and 60 per cent were eight days or longer in duration. Approximately 40 per cent were not only disabling but caused confinement into bed.

It is evident, therefore, that in the main the illnesses recorded were more than trivial in their character, in spite of the fact that in some instances mere symptoms were given as diagnoses.

There are certain facts from this study that stand out with particular significance. First, the extraordinarily high incidence of sickness shown in early childhood was a rather surprising result. Illness was far more frequent under 10 years of age than at any other time of life.

Second, the interesting suggestion was afforded that the average individual is more free from illness in the age period 15 to 24 years. Thereafter sickness becomes more frequent as age advances, and it may be added, upon the basis of other studies as well as these, that sickness becomes more severe and more frequently fatal.

The picture given by the record of sickness according to causes, or more precisely, according to the kind of sickness, is in sharp contract to that given by causes of death. Respiratory diseases and disorders account for 60 per cent of sickness as against 20 per cent of deaths.

The general group of "epidemic, endemic, and infectious" diseases account for 8 per cent of illness whereas only about 2 per cent of the deaths were due to this group. Digestive diseases and disorders caused 10 per cent of the illness as against 6 per cent of the total deaths.

On the other hand, the group of general diseases (which includes cancer, the diseases of the nervous and circulatory systems and the diseases of the kidney and related organs) were relatively much more important causes of death than of sickness. The diseases of the heart and blood vessels show the sharpest contrast—24 per cent of deaths are due to these conditions—as against only 2 per cent of the sicknesses.

In other words, these diseases manifest themselves relatively rarely in definite attacks of sickness although they undoubtedly shorten life and make life much less enjoyable while they last.

The prevalence, of "chronic" conditions as asertained by this study is of interest. Of each 1,000 individuals on the average 34 were affected with arthritis, lumbago, and myalgia; 22 with neuralgia, neuritis, and sciatica; 21 with diseases of the heart; 10 with chronic indigestion and other intestinal disorders; 10 with appendicitis; and 7 with nephritis.

The further query suggests itself: At what age is the individual least able to withstand disease after he has been attacked? One way to measure this is to compare the attack. The greatest resistance to death is childhood, being the age period 5 to 14. The lowest resistance is in infancy and early childhood, 0 to 4 years, and in middle and old age.

CHRONIC CONDITIONS OF ILLNESS RECORDED

Ability to survive illness thus varies markedly from resistance to illnesses at different ages, particularly in childhood (5 to 14), when the average individual suffers from illnesses frequently but has a relatively small chance of dying, and in the older years, when not only does his susceptibility to illness increase, but also his chance of death. This is due partly, of course, to the nature of the illness occurring at these ages, and partly to the diminished ability to resist the diseases which manifest themselves in sickness.

It is believed that one of the most important lessons to be drawn from this study is that public health has as yet barely touched the task of preventing the conditions which manifest themselves in physical and mental impairments, in nefficiency and illness, and in postponable death. Plague and pestilence, infant and child mortality from infectious and intestinal disorders, have been diminished, and healthful living is being established more and more firmly as a popular ideal; but aside from these the prevention of disease remains as an outstanding problem yet to be solved.

The hope of the future lies in the continued and increasing growth of scientific knowledge which can be applied to the protection against disease, and the promotion of the public health.

That report did not receive anything like the amount of attention throughout the country it should have, and it did not strike me so forcibly until I studied the figures which are given in so many per thousand of inhabitants. Taking the population of this country as 120,000,000 of people, and taking the Surgeon General's report on the actual facts published, I have interpreted the report in terms of the Nation and I tell you it is amazing when you see those figures which I submit.

Last year there suffered from colds and bronchitis in our country 50,232,000 people. From influenza and grippe, 17,184,000; diseases of the digestive system, 11,580,000; tonsilitis and sore throat, 7,884,000; diseases of the nervous system, including headaches, 5,292,000; measles, 4,104,000; whooping cough, 2,712,000; rheumatism and lumbago, 2,616,000; heart and other circulatory diseases, 2,196,000; and hay fever and asthma, 600,000. When you think of that in terms of the Nation, which is subject to error, more or less, on one side or the other, because they had to confine their activities to a typical town, but it is accurate, it is amazing. Those millions are simply the figures interpreted in terms of the population of the United States. They are called the minor diseases.

(The statement later submitted by Doctor Herty is here printed, as follows:)

The figures in this report are far more startling when interpreted in terms of the entire population of the country. Within reasonable limits of accuracy they indicate the following number of cases of certain kinds of sickness within the borders of the United States:

Colds and bronchitis	50, 232, 000
Influenza and grippe	17, 184, 000
Diseases of the digestive system	11, 589, 000
Tonsilitis and sore throat	7, 884, 000
Diseases of the nervous system, including headaches	5, 292, 000
Measles	4, 104, 000
Whooping cough	2, 712, 000
Rheumatism and lumbago	2, 616, 000
Heart and other circulatory diseases	2, 196, 000
Hay fever and asthma	600, 000

Furthermore, it should give rise to serious thought when we read from the report of Dr. George T. White, secretary and manager of the Association of Life Insurance Presidents, that while the death rate among the policyholders of the 52 legal reserve life-insurance companies was 828 per 100,000 policyholders in 1921, nevertheless the corresponding figures for 1927 were 823.5, a decrease of only 4.5 deaths per 100,000, which is equivalent to a decrease of only 0.045 of 1 per cent, and this in spite of all the wonderful developments in science during that period of six years.

Entirely apart from the inconvenience, the suffering, and the sorrow, what an economic loss this represents—inefficiency in work, absenteeism from daily duties, prolonged stays in hospitals, expense of medical treatment, a tremendous loss from the productive capacity of our citizenry when interpreted in money terms—as has been so clearly demonstrated by calculations of Dr. Louis I. Dublin, chief statistician of the Metropolitan Life Insurance Co., whose letter on this subject will be incorporated in these hearings.

Three estimates of the annual repair bill of the human frames of our citizens, namely, the cost of medical service, have been made. Doctor Dublin estimates about $1,000,000,000; my estimate is about $1,015,000,000; while the Red Cross estimates $60 per family annually, which is the equivalent of practically $1,500,000,000.

To this great amount must be added further loss from wages, etc., amounting to at least $2,000,000,000, and finally some $6,000,000,000 as representing the financial value of those lives which have been lost through premature death from preventable diseases. Certainly the loss from those sicknesses which at present we do not know how to control represents on a conservative basis at least an equal amount. We thus reach figures of startling magnitude, far exceeding losses from floods and other national disasters, and these are annual losses. If these losses are to be reduced the only sure road is that of scientific research with its results vigorously applied.

Within the last few years industry has suddenly awakened to the all-important rôle of research in the creation of wealth. I predict that within the next few years there will be an equal awakening throughout this country of the similar rôle which scientific research must play in the betterment of health.

Splendid work is being done to-day in privately endowed institutions, in our universities and medical schools. Happily these means are being added to constantly from the wealth of our citizens who seek this channel of usefulness to humanity for the bestowal of their funds. The fine work of the Hygienic Laboratory of our Public Health Service is well known to all, but its quarters are inadequate, its equipment limited and its personnel too small, because of restricted Government appropriations, for the great work through fundamental research which this Government should undertake in behalf of its citizens, each of whom bears his or her share of sickness. Such a laboratory as is contemplated should be equipped with the very best, and the latest forms of apparatus for experimental work in the problems of physics which bear so directly on health. Industries connected with transportation and communication have monopolized too large a proportion of research in this field.

So too in the field of biochemistry untold problems await solution. The study of the endocrines, physical chemical problems of equilibrium and rates of reaction, the chemical basis of bacteriology, the unexplored field of immunization,

these together with many others, await the solution of the scientist and application by physicians and surgeons for the benefit of humanity.

To this great end it will be necessary that a constantly increasing number of thoroughly trained research workers, men and women must be trained in order that these various problems may be simultaneously attacked. With the provision of fellowships contemplated in this bill there can be no question of the fact that when positions open for the best qualified there will be a great trend in our graduate schools for training in these subjects. If this committee could visit, as I did last January, the Mayo clinic in Rochester, Minn., and see there the active prosecution of research being carried on by graduate students of the University of Minnesota and by the Fellows of the Mayo Foundation under the leadership of the experts of the Mayo clinic staff, you would readily catch a vision of the great service that could be rendered if Congress will make the means available for providing a still greater organization of this type.

In this very connection I recall a most interesting conversation with a distinguished physician of New York City, who died recently, and who was for many years a teacher of medicine in one of the great medical schools of New York City, namely, Dr. Frank S. Meara. Discussing this subject one evening after dinner he expressed the conviction that the time was rapidly approaching when our medical schools would turn out two entirely different types of trained men, namely, researchers and physicians; the former to push forward the bounds of knowledge of sickness, the latter to apply the new knowledge in their daily ministrations.

I believe that these hearings mark the inauguration of a new period in our country's history, namely, the adequate participation by the great mass of our citizenry in the support, through abundant congressional appropriation, of fundamental scientific research for the benefit of health.

Senator RANSDELL. I wish to insert in the record at this point a letter written by Dr. William J. Mayo, the eminent surgeon of Rochester, Minn. The letter follows:

APRIL 23, 1928.

Mr. CHARLES R. HERTY,
The Cosmos Club, Washington, D. C.

MY DEAR MR. HERTY: I am writing you concerning the Ransdell bill (S. 3391), which I believe is to have an early hearing, to add my indorsement of this measure whose purpose is to create within the United States Public Health Service a national institute of health and to further through governmental channels researches into the cause, prevention, and cure of disease.

The bill introduces no new economic principle, for Congress is committed to the policy of appropriating Federal funds for research, but seeks only to do for the physical welfare of our citizens what is already being so well done for crops, cattle, forests, minerals and industry, and constitutes a means through which the individual citizen can contribute his share to the support of that scientific research which bears so directly upon the welfare of himself and his family.

The first duty of the State is the care of the health of its citizens. By means of public health measures in the last 60 years, the average life of man has been prolonged 12 years. This extraordinary result has been brought about through researches by medical men, and has been possible only through the cooperative labor of many investigators. The physician in his ministrations applies for the benefit of his patients the best which science offers.

The application of the pure sciences of physicochemistry to clinical medicine has opened up a wonderful field, which on investigation will yield knowledge of incalculable value to mankind. Physicochemistry of the human body concerns life itself. The recognition of chemical changes in the body and their influence on metabolism is now one of the important factors in the estimation of the physical condition of man. Medicine has become a branch of applied chemistry, and on its development along this line depends the control perhaps of cancer. The problems awaiting solution are many and the difficulties of experimental work are great, but there is available the effort of trained and indefatigable scientific workers, to whom governmental indorsement of their undertaking would bring courage and inspiration.

Very sincerely yours,

W. J. MAYO.

I wish to insert in the record at this point a letter from Dr. W. W. Keen, who has been for many years one of the outstanding medical

men of the country. He is president of the American Philosophical Society. At his advanced age of more than 91 years, he writes commending most heartily this bill. The letter follows:

APRIL 21, 1928.

MY DEAR SENATOR RANSDELL: I have received from a friend a copy of bill S. 3391, establishing a national institute of health. I deem it one of the most important bills before Congress at this session. I sincerely hope that it will be carried through without serious opposition.

I am only sorry that my age (over 91¼) will not allow me to go to Washington to give my testimony in person at the hearing on the 24th instant.

Sincerely yours,

W. W. KEEN.

Hon. JOSEPH E. RANSDELL,
United States Senate, Washington, D. C.

I wish to insert in the record a letter of Dr. Lewellys F. Barker, who is a distinguished physician of Baltimore, who feels that the creation of an institute of health by the Government should prove to be one of the best investments ever made by our people. The letter follows:

BALTIMORE, *January 7, 1927.*

Hon. JOS. E. RANSDELL,
United States Senate, Washington, D. C.

MY DEAR SENATOR RANSDELL: Thanks for your letter and for the inclosed copies of your bill to create a national institute of health, as well as a copy of the speech delivered by you in its support.

If our legislators are wise enough to create the institute contemplated it would, in my opinion, prove to be one of the best investments ever made by our people.

Very sincerely yours,

LEWELLYS F. BARKER.

I wish to insert in the record a letter from Dr. George E. Vincent, who is the president of the Rockefeller Foundation, an organization over which he has presided so successfully for many years, and through which large contributions have been made in the elimination of disease throughout the world. Doctor Vincent is heartily in favor of this measure. The letter follows:

THE ROCKEFELLER FOUNDATION,
New York, February 5, 1927.

MY DEAR SENATOR RANSDELL: Your letter of January 22 was acknowledged in my absence by my secretary, on January 25. Since my return, I have had an opportunity to talk with my colleagues about Senate bill 4540, which proposes the establishment of a national institute of health.

While it is the policy of the Rockefeller Foundation carefully to abstain from taking the initiative in any efforts to influence legislation, we are always glad, in response to requests from legislative committees, or members of legislative bodies, to express opinions with respect to projects in the field of public health and medical education.

The following suggestions have a bearing upon the plan in which you are interested:

The Hygienic Laboratory of the Public Health Service, although a small institution, has done excellent work. Its field of activities, its staff and resources are, at present, altogether too limited. A plan to extend the scope and resources of this laboratory into an adequate research institute would seem to be sound public policy.

The Public Health Service is peculiarly well qualified to cooperate in research problems which have a bearing upon public health, because many of these problems call for investigation, not only in the laboratory, but in the field. Moreover, the results of laboratory research need to be tentatively applied in the field before an efficient working program can be developed.

The Federal Government should, through a well-equipped laboratory or institute of hygiene, be in a position to take the lead in this country in the investi-

gation of problems in hygienic sanitation, communicable diseases, and the promotion of health generally. It is unlikely that the States can individually support institutions which are properly qualified to make studies of this kind.

It is true that the State of Massachusetts, for example, has made studies of the purification of water by filtration and the treatment of sewage, which have been utilized by all the States and by foreign governments. Work of this sort, however, ought to be a function of the Federal Government laboratories in Washington, in cooperation with State laboratories throughout the country.

The Federal Government should also, it seems to us, study public health in its broader aspects, with the idea of increasing our knowledge of the nature, the causes, the methods of control and of prevention of the more common, as well as of rare diseases from which the public may be safeguarded.

Work of this character has been well done recently by individual States. A notable example is the New York State campaign for the prevention of diphtheria, which has been highly successful and will no doubt influence the policies of other States.

Similar investigations and demonserations of control are awaited with respect to scarlet fever, measles, mumps, infantile paralysis, epidemic encephalitis, and many other important diseases.

While it is true that progress is being made in our knowledge of these diseases through investigation in university laboratories and clinics throughout the world, it would seem to be a duty of our Federal Government to take an appropriate and adequate part in this world-wide cooperative scientific work. The Governments of England and Germany have set conspicuous examples of officially supported scientific inquiry.

In order that a government institute may be in a position to do its best work, it should be given a reasonable measure of autonomy. It is to be feared that Government routine, dictated by the many laws of Congress, the comptroller, and the Director of the Budget, while necessary for ordinary Government expenditure, would prove a detriment rather than a help to a research institution.

In certain countries, laboratories of this kind have been granted considerable autonomy through special charters, separate boards of trustees, the right to receive and hold funds and to control the scientific work. Governments make annual lump-sum appropriations to such autonomous groups without attempting to specify the detailed expenditures of the grants.

While our Federal Government has in the past been content to follow rather than to lead, there is no reason why, with such adequate provision as is proposed in your bill, a valuable leadership in research might not be assumed by an official laboratory or institute in Washington.

One other factor in the development of a research institute calls for special emphasis. In order to attract and hold in Government positions persons capable of productive research it is essential that salary scales, retiring allowances, official status, and recognition should be adequate to the point of generosity. If the Government is to compete successfully for brains with privately endowed institutes, it must make the governmental posts sufficiently attractive and secure. This is another reason for autonomy.

It is a source of gratification to us who are interested in scientific research and public health to know that you are giving attention to these fundamentally important factors of national efficiency and welfare.

With assurances of high esteem and best wishes for the success of your efforts, I am,

Sincerely yours,

GEORGE E. VINCENT.

Senator JOSEPH E. RANSDELL,
United States Senate, Washington, D. C.

I wish to insert in the record a letter from Mr. E. T. Bedford, who is president of the Corn Products Refining Co., one of our important industrial organizations in connection with the chemical utilization of the corn crop of our Middle Western States. Mr. Brown is an employer of a vast amount of labor, and in his letter refers particularly to the economic waste from sickness. The letter follows:

NEW YORK, N. Y., *April 23, 1928.*

Hon. JOSEPH E. RANSDELL,
United States Senate, Washington, D. C.

MY DEAR SENATOR: I have been informed that S. 3391, a bill to establish a national institute of health, to authorize increased appropriations for the Hygienic Laboratory, and to authorize the Government to accept donations for use in ascertaining the cause, prevention, and cure of disease affecting human beings, and for other purposes, introduced by you, is scheduled for hearing before the Committee on Commerce on April 24. I wish to take this opportunity to express our approval of what this bill intends to accomplish and to urge its enactment by the Congress. While I fully appreciate and deeply sympathize with the humanitarian side of our health problem, I am especially impressed with the tremendous economic waste to which our country is subjected by reason of the many preventable diseases and illnesses which interrupt and disturb normal pursuit of our national activities. There is no doubt in my mind that if this bill is enacted and efficiently administered, the appropriation involved will be returned to our people many times through increased happiness and national productiveness.

Yours very truly,

E. T. BEDFORD,
President Corn Products Refining Co.

I wish to insert in the record a letter of Dr. James L. Fieser, who is the vice chairman of the American Red Cross, who, in spite of their customary policy of withholding opinions on legislation, nevertheless makes an exception in this case, and warmly commends the purposes of this bill. The letter follows:

THE AMERICAN RED CROSS,
Washington, D. C., April 21, 1928.

Hon. JOSEPH E. RANSDELL,
United States Senate, Washington, D. C.

MY DEAR SENATOR RANSDELL: Receipt is acknowledged of your letter of April 17 inclosing a copy of your bill (S. 3391) to establish a national institute of health, to authorize increased appropriations for the hygienic laboratory, and to authorize the Government to accept donations for use in ascertaining the cause, prevention, and cure of disease affecting human beings, and for other purposes.

In view of the close relationship between the Red Cross and the Federal Government, we have always been very careful not to become involved in pushing legislation in an aggressive way. This policy has seemed wise both by reason of the Federal cooperation which we always have, particularly in time of disaster, and because the democratic membership of the organization is inclusive of such a wide variety of opinion. I am sure, however, that the purpose of your bill to create a national institute of health whose objective is the prevention of sickness and the promotion of health through the location of causes of disease, commends itself to every American as a desirable one. I wish you every success in securing the passage of the bill.

With kindest personal regards, I am,

Sincerely yours,

JAMES L. FIESER, *Vice Chairman.*

I wish to insert in the record a letter from Mr. Ludvig Hektoen, who at the time of writing this letter was the chairman of the medical section of the National Research Council, the body directly allied with the National Academy of Sciences, to which, under its Federal charter, the Government looks for scientific advice. Mr. Hektoen was in hearty accord with this measure. The letter follows:

NATIONAL RESEARCH COUNCIL,
Washington, D. C., January 18, 1927.

Hon. JOSEPH. E. RANSDELL,
United States Senate, Washington, D. C.

MY DEAR SENATOR: I have read your letter of the 13th, bill S. 4540, and your speech in the Senate on July 2, 1926, with special interest and attention. I find myself in hearty sympathy with your project to expand the investigative facilities of the Public Health Service and its Hygienic Laboratory, and I shall

be glad to present myself, if possible, before your subcommittee at its convenience. I await your pleasure.

Very truly yours,

LUDVIG HEKTOEN,
Chairman Division of Medical Sciences.

I wish to insert in the record a letter from Dr. Louis I. Dublin, who is the chief statistician of the largest of our insurance companies, the Metropolitan Life. With the large staff at his disposal and the valuable data in possession of that organization, Doctor Dublin has made extensive researches into the money value of life and the economic losses from sickness, disease, and premature death. Doctor Dublin is very strongly in favor of this measure. The letter follows:

METROPOLITAN LIFE INSURANCE CO.,
New York City, April 20, 1928.

Hon. JOSEPH E. RANSDELL,
United States Senate, Washington, D. C.

DEAR SENATOR: I have your letter of April 6 in which you asked me to attend the hearing on Senate bill 3391 on Tuesday, April 24. I had confidently expected to attend the hearing until to-day, but pressure of many engagements here will make it impossible for me to be with you. May I, however, say a word in connection with your endeavor to further the establishment of a national institute of health and to accelerate investigation into the problems of public health.

I am very strongly in favor of your measure and hope that it may be reported favorably by your committee. Ten million dollars, which it is proposed to appropriate for the purposes of the bill, is undoubtedly a large sum, especially in these days of necessary economy of government. On the other hand, this amount must be considered relative to the stakes which are involved. I have on various occasions indicated as the result of certain researches which we have conducted in this office that human life is the most valuable asset of our Nation; that it exceeds five-fold the national wealth, including real property, livestock, manufactured goods, machinery, and valuables of all other sorts. We are prone to forget the inherent economic value in the human life. Even in the lower economic levels where earnings of the entire family from all sources do not exceed $2,500, the economic value of the young wage earner is about $30,000. The public-health movement has demonstrated with complete assurance that, at the present time, with all of our health advances, hundreds of thousands of lives are sacrificed to ignorance and neglect and that the total economic money value of these lives is close to six billions of dollars. Preventable disease, likewise, costs us well over two billions of dollars a year. These are the stakes for which the public-health program is playing. An appropriation of $10,000,000 seems like a very small sum if it will succeed, as there is every reason to believe it will, in giving us information with which to combat premature death and preventable incapacity. Who can tell what the economic value was of a discovery by the yellow-fever commission of the method of transmission of yellow fever; or who shall say what the economic value ultimately will be of the discoveries of Banting and Macleod which are helping to control diabetes? A whole host of pressing problems in the public-health field demand solution. The expanded facilities of the hygienic labortory of the Public Health Service conceived by your bill would help materially in the solution of many of these questions.

I hope the discussion at the hearing will bring out that there is no more economic measures than the one you are considering here. Our nanual loss of life involves tremendous wastes which in industry would not be tolerated for a moment. We have no greater assets than human life and they should be preserved. There is no better way than to discover the ways by which life and health are sacrificed. I am inclosing herewith an address which I presented before the Institute of Politics at Williamstown, Mass., in which these questions are more fully considered, and you will find in it the detailed information which justifies the comment I have made above.

With all best wishes for your measure, I am,

Sincerely yours,

LOUIS I. DUBLIN, *Statistician.*

The Economics of World Health

By Louis I. Dublin

[Reprinted from Harper's Monthly Magazine, November, 1926]

One shudders a bit at the very thought of an economic evaluation of life. How much is a mother, a wife, or a child worth? The very words leave one cold, for life in its full implications is not commensurable with money. Life and health have a much higher and deeper value for us than money; in fact, they give value to everything else. Life and health are ends in themselves. They do not require any further justification for their conservation. If, therefore, in this paper I appear to evaluate life and health in terms of dollars and cents, it is not because that is the only way of evaluating them. I am simply attempting to place a money value on one very narrow aspect of life, namely, its actual cost to maintain, and its productive value in terms of dollars and cents. In this sense alone life and health have economic value, and their evaluation on this basis should render a real service to those who are engaged in their protection.

It is a habit with us Americans to emphasize the importance of our national wealth, but always in terms of real property, machinery, and of manufactured products. We quite forget that human life exceeds in value all such goods by a very large margin. Human capital is the Nation's greatest asset. No wonder that we are wasteful of our human resources. We appreciate the value of life and health only when we lose them. It is when earnings cease through illness and expenses mount that we recognize the value of life and health. It is when the breadwinner of a family is removed through accident or disease and the mother and young children must become self-supporting that first the dependents and later the community realize the large capital value which has been lost. But even if such circumstances bring us the realization of the value of the individual, we give ordinarily little thought to the value of our living assets as a whole. We express in a hundred ways this indifference and lack of understanding. We are free with money as no other people, but are niggardly, indeed, with expenditures that are intended to conserve life and health. We do not realize how great are the immediate possibilities for saving our human resources and how profitable an investment life conservation can be.

To lay a foundation for the proper understanding of the economics of life and health it is necessary first to determine some items in the cost of human life and to discover also the net value of the earnings of average individuals. For a number of years my associates and I have been engaged in making a series of computations along these lines. Our first task was to calculate what it costs to bring up a child in a typical American community to age 18, when he may become self-supporting. Our computations were for the great body of wage-earning families of the country whose total family resources are about $2,500 a year. Under present conditions the cost of rearing a child in such families to the age of self-support, including all the usual items of food, shelter, clothing, education, etc., is $7,238. Including interest on the capital and making due allowance for the cost of those who do not survive age 18, the amount is increased to a little more than $10,000. This amount does not include one very important item, namely, the money value of the mother's care. We were compelled to limit ourselves to the family's money income, but we recognize that the working mother makes a real contribution to the total income of the family; for if wages were to be paid commensurate with the mother's value in the bringing up of children, the sum would be considerable and would add materially to the $10,000 actually spent by the family in raising a child to self-support. Our figure is therefore, a minimum and will serve to keep our other calculations conservative.

The cost of bringing up a child may be looked upon as capital invested which will produce future returns. The process of raising children may be compared with winding up a piece of machinery which is later expected to do useful work. From an economic standpoint the bringing up of children is an investment; in fact, a very profitable investment, not so much for the immediate family as for the community as a whole. The great majority of adults produce a good deal more than they consume and add to the capital value of the communities in which they live. If this were not so, the total national wealth would not increase as rapidly as it has during the last century. Our second effort accordingly was to compute the value of a man as a wage earner; that is, to determine the returns from the investment in human capital. Our computation proceeded with the same group of people, namely, those who were in the $2,500 income

class. We did not include the money equivalent of the wife's services. But, disregarding this item, we found that the present worth at age 18 of his future earnings was calculated well in excess of $41,000, and the present worth of his future expenditures less than $13,000. The present worth at age 18 of the net future earnings of a man in this economic class was accordingly close to $29,000. The maximum value of a man in this income class is reached at age 25, when the present worth of his net future earnings is more than $32,000. With advancing age, the present worth of net future earnings declines. At 50, it is $17,510; at 60, about $8,500. After age 70, the present worth of net future earnings is negative because earnings cease and the cost of maintenance continues. An astonishing item in our calculations is the high economic value of a child at birth. We found the sum to be $9,333. This is the amount which it would be necessary to put at interest at 3½ per cent, in order to bring up the child to age 18 and to produce the net income throughout the working period of ife.. At age 5, the corresponding figure is $14,156 and at age 15, $25,341. If we had assumed a higher rate of interest than 3½ per cent, the amounts would have been correspondingly smaller; at 4½ per cent, the value at birth would be one-half as high. But in any case, the money value of children is no small matter. They represent, in a sense, the value of the social inheritance which comes to a human being because he is born in an economically organized state.

In the same manner, we computed the value of a man whose maximum earnings are $5,000 a year. This represents a fairly large group of professional and small business men who have had better opportunities to advance themselves than their fellows. At age 18, the present worth of the net future earnings of a man in this group was found to be $34,320. The actual maximum value occurs at age 32 when the net future earnings are worth $49,100. The $2,500 man reaches his maximum value seven years earlier at the age of 25, but his value as a producer is then $17,000 less. The value of a child at birth in this group is $9,629 and at the other ages of childhood the figures are only a little more than those I have quoted for the children in the $2,500 income families. This is because of the much higher cost of bringing up a child in the higher income class.

It costs money to raise human beings to the point of self-support, at least $10,000, as we have seen. When they being to work they produce a great deal more than they cost. We have calculated from the data which I have just presented to you—the value of males in the $2,500 income class—what the 60,000,000 male persons in the United States are worth. That is, we have computed, with regard to their present ages, the sum of their net future earnings. The aggregate figure is considerable over a thousand billion dollars. Unfortunately, we are not able to compute with the same exactness the economic value of the female population because the housewife's contribution to the family budget can not be measured in dollars and cents. But, there are more than 8,000,000 gainfully occupied women in the United States, and those that are not gainfully employed have decided economic value to their families and to the State. If we estimate that the economic value of women in general is only one-half that of men, this will make the value of that sex $500,000,000,000 and the total vital assets, males and females combined, over $1,500,000,000,000. Our national wealth in material assets in 1922 was $321,000,000,000. This includes real property, live stock, machinery, agricultural and mining products, and manufactured goods of all sorts. Our vital capital, therefore, exceeded our ordinary material wealth about five to one.

II. This striking relationship between living capital on the one hand and material capital on the other is not limited to the United States, although it is possible that the difference between the two may not be as great in some other countries. Professor Nicholson, as far back as 1891, estimated that the living capital of the United Kingdom was five times that of all other capital. It would be a laborious task to determine the corresponding figure for England and Wales at the present time or to check up the figures for other nations. But, I should not be surprised if somewhat similar figures were obtainable in all civilized countries. For, even if human values, man for man, are economically lower in other lands than in our own because of lower per capita production and lower wages, the same relationship probably holds between live capital on the one hand and other forms of wealth on the other. In any case, we must see very clearly how great is the value of human life the world over. The figures I have quoted suggest how necessary it is to give due consideration to an effort to conserve this, the most valuable of our national resources.

With these figures as a background, we are now in a position to realize somewhat the losses which result annually from the interruptions due to illness and

death. Our bodies are, after all, machines which need occasional overhauling. They wear out sooner or later, depending a good deal upon the care they receive. Sickness is one of the commonest of the facts of life and one of the most disturbing, as it interferes with production and breaks up normal family routine. It will be interesting to estimate the total economic loss sustained in this country on account of illness. Some years ago Doctor Frankel and I made a series of studies on the extent of sickness among a half million insured persons. The figures showed that about 2 per cent were constantly sick. Other observers, following similar methods, have confirmed our results, namely, that the average individual in the United States loses about seven days each year from sickness involving inability to work. There are additional days of discomfort which interfere more or less with a person's duties, but these were not included in the statistics Converted into economic terms, this means that there is a loss of 2 per cent of total current production. This, in round numbers, amounts to more than a billion and a quarter dollars annually in the United States. To this figure should be added the cost of such items as medical care, hospital service, drugs and appliances, and the like. To ascertain the extent of these expenditures we made an investigation of the cost of sickness among a group of people and found that the average annual expenditure was $19 per capita for medical and nursing care and other items necessary in illness. This figure is probably higher than the average for the general population because the group studied had a rather favorable economic status. But, even if half this figure be used, say in round numbers $10 per capita, the total cost of medical care, including all items, would amount to more than a billion dollars a year. We may, therefore, say with confidence that sickness cost directly in lost wages, in reduced production, as well as in the necessary care, a total of two and a quarter billion dollars a year.

Huge as these figures are, they do not cover the total which should be placed to the account of illness. In many instances sickness causes premature death, removing individuals in their prime when they have real and large economic values. Somehow, we must evaluate the total community losses which result from this item of premature death. I have calculated that about a third of the deaths which occur every year, even under the present conditions, are preventable. To be sure, the great bulk of such preventable deaths are in infancy and childhood. But I have shown you that even at these younger ages human beings have considerable monetary value. Every year 120,000 babies die from altogether preventable conditions during the first year of their life. There is no reason for this slaughter except the ignorance of mothers and the indifference of the communities where they live. Possibly it might make a difference if our legislators realized that these babies have a capital value of more than $9,000 if they are boys, and of $4,600 if they are girls, and that the capital lost throughout the country from this preventable infant mortality reached the astounding figure of more than three-quarters of a billion dollars a year. If there are those who question my mathematics, I can still counter by recalling that there are enough preventable deaths of adult men and women which would make a real impression on economic production, to say nothing of the general happiness of the people of the United States. Every year more than 30,000 young men and women between 25 and 29 years of age die from entirely preventable causes, and their capital value, having in mind their net future earnings, is about three-quarters of a billion dollars. Having due regard for the value of life at each age period, I estimate that the total capital value of the lives which can be saved annually through the application of modern preventive medicine and public-health measures is over six billions of dollars. The losses, as you see, from sickness and preventable death are enormous, as one might very well expect in view of the immense value of human life in the United States.

III. One would think under such conditions that no effort would be spared to conserve our living resources. But we have scratched only the surface of the possibilities in this direction. It would be quite unfair, however, to give the impression that nothing has been accomplished. The gains in extending human life and preventing sickness have been really considerable during the last half-century. There is already abounding evidence that the work of the public-health authorities to prevent illness and to conserve life, considered from a purely economic viewpoint, pays large dividends. Let us take the situation in a city like New York. The results are fairly typical of what has happened in other large centers of population. In 1875, the death rate was 28.3 per 1,000; in 1925, it was 11.5, or a reduction of 59.4 per cent. A better measure of the improvement is perhaps the gain in average duration of life. In 1880, the average life-span was about 40 years in New York City and most likely in other urban

centers in the United Sttes. It is now 55 or 56 years, a gain of about 15 years in less than a half-century. The greatest gains have been achieved recently. In 1901 a baby born in the United States registration area might expect to live 49.24 years; this expectation of life has now risen to 57.32 years. The present figures are not accidental but the result of a definite trend which has been fairly continuous for a whole generation, reflecting the work of a new force in the life of the people.

It will be interesting to examine the facts of the death rate for a number of the more important causes. The diseases which have been most reduced are those which affect infants and young children. In the last 20 years the infant mortality rate has been cut 60 per cent. In the past one might almost have said that babies were born to die, for as many as one-quarter of them did not survive the first year. To-day, in most American communities, only about 7 per cent die during that first difficult year and two-thirds of these deaths will be prevented in the near future. Not long ago typhoid fever was a common cause of sickness and death throughout the United States. Even as late as 1900 the death rate was 36 per 100,000 in the registration area. Epidemics raged in the large cities of the country because of polluted water supplies and because little was done to prevent the spread of the disease through secondary infection. But, with the installation of excellent water systems in the larger cities of the country, the typhoid fever death rate dropped in an amazing manner. This disease is now not far from extinction, certainly in the northern and urban sections of the country. The public health campaign has been especially successful in the reduction of tuberculosis. In 1900, the death rate from this disease was 195 per 100,000. It is now less than one-half as high. More than 100,000 people are kept alive each year who under the old conditions would have succumbed to this disease alone. Diphtheria is another disease which the public health movement is on the point of wiping out completely. At the end of the last century this was one of the most important causes of death among children. When the first registration figures became available in 1900, this disease had a death rate of 43.3 per 100,000; in 1923, this was reduced to 12.1, and it is rapidly dropping everywhere throughout the country. To-day we are considering seriously the possibility of the complete elimination of diphtheria by 1930 in such large areas as the State of New York. The more widespread application of known methods of prevention such as the general inoculation of children with toxin-antitoxin will completely conquer this scourge of childhood.

Possibly the most striking demonstration of the effectiveness of the modern health campaign is the experience of the Metropolitan Life Insurance Co., with its millions of industrial policyholders. Seventeen years ago this organization instituted a program of health education and of nursing service for its working-class members. This business organization has expended altogether over $20,000,000 in this campaign. It has increased its annual budget for welfare work in response to an ever-increasing demand for service and also to the increasingly favorable results of the work done. For during this period the mortality rate has declined more than 30 per cent and the accumulated saving in mortality between 1911 and 1925, which can be ascribed only to the welfare work of the company, has totaled the amazing sum of $43,000,000, or twice the total expended. During this period of the demonstration the death rate from tuberculosis among the industrial policyholders has been reduced over 56 per cent; from typhoid fever the reduction has been about 80 per cent; from the communicable diseases of childhood the reduction was 55.5 per cent; and from diphtheria alone the reduction was over 62 per cent since 1911. In every important condition the death rate has declined among the industrial policyholders fully twice as fast as has occurred in the general population. As a result, the expectation of life of this group of workers and their families has increased by nine years during the interval, whereas the corresponding increase in the general population is about five years. Health work, when properly undertaken and adequately financed, pays by every test of a modern business organization.

IV. These achievements in the field of public health, both official and private, have completely changed the life of the average citizen in the modern State People in our country at least no longer live in dread of the plague, of cholera, of yellow fever, of virulent smallpox, or of pernicious malaria, and a host of other specters. If they pass the rigors of childhood, they are generally able to round out a good expectation of years, to bring up their families, and otherwise to live a normal and happy life. Never, probably, in the history of the world has there been such widespread well-being for great masses of people. This is, I believe, in large measure, the response to the great improvement in health conditions

which has occurred. Increased efficiency and huge productivity, uninterrupted by illness or preventable death, have ushered in many advantages which follow from a high level of economic well-being.

In spite of these achievements, there is still a large field to cultivate. Tuberculosis still causes a hundred thousand deaths annually and a loss of about two and a half years in the average expectation of life of the entire community. If this disease could be eliminated just that number of years would be added to the expectation of every member of society. Accidental deaths are becoming more frequent with the extension of the use of the automobile and the development of industry. The elimination of accidents would add more than a year to the average expectation of life. A goodly proportion of the deaths from heart disease, certainly those which occur at the younger ages, are preventable, and their prevention would add appreciably to the life span. And, thus in its entirety, if we were but willing to utilize the knowledge which we have of preventive medicine in the life of the American people, we should raise the expectation of life from its present point of 57 or 58 years to close to 65. The discovery of a method to control cancer and a few other obscure diseases would further increase this expectation appreciably. But, even if we discount these future discoveries and limit ourselves to the application of such knowledge as we now have and which is only waiting to be applied, an average duration of life of 65 years is an entirely possible one for the American people. The people of New Zealand are very close to such an achievement at the present time. What they can do we, with our superior resources, can do likewise.

We are confronted, therefore, with a very real situation. We know how great is the value of human life. We know also how great are the current losses from sickness and death. We have the knowledge and the necessary resources for the control of disease. Obviously, we must put our knowledge to work. That is the program of the public-health movement of the immediate future. To-day, public-health work is in its infancy in spite of its achievements and the demonstration of its power. Most American communities still have political health administrations, inadequately financed, inadequately manned. Less than 50 cents per capita probably represents the total expenditure of the American people for public health. The money spent for medical service is almost altogether for the care of disease and not for its prevention. The relationship were better reversed. A new era of intensive public-health work must be brought about which will make available to the American people the power of this new branch of science. Expert opinion of public-health officials indicates that an expenditure of $2.50 per capita wisely directed through organized channels against the preventable diseases and for public-health education would reduce the annual death rate two points per thousand and correspondingly increase the expectation from five to seven years. The money value of these added years of life as we have seen, runs into billions of dollars. There is no greater opportunity for a quick and more certain return on any investment than an investment in public health. The people of the United States and, in fact, of the whole world, have not waked up to the enormous possibilities of profit in preserving life and health.

V. I am not unmindful of the fact that my subject is the economics of world health and that I have given very little consideration to other countries than the United States. This I have done because, as an American, I am most interested in the United States, and also because our country presents a rich detail of data not always present for other countries of the world. We can fortunately establish a basis for the development of an international viewpoint on health matters through the consideration of American conditions. There is, of course, a world-aspect to our problem, and I shall say a word with regard to that.

Much the same conditions exist to-day the world over, although countries vary somewhat with regard to the prevalence of disease, the expectation of life, and the conomic value of their citizens. But, everywhere there is a great opportunity for the extension of health and for the prolongation of life and the increase of capital assets. It was in England that the modern public-health program took form and developed; and it is not surprising to find that among the English-speaking peoples the very best conditions of longevity and productivity occur. It is in far-away New Zealand that the longest average lifetime is found. The expectation of life at birth is more than 62 years in that country, and only a little less in Australia. The Scandinavian countries, Denmark, Norway, and Sweden, which very early applied the newer public-health procedures, have conditions very much like those of the United States, perhaps even a shade better, namely, an average expectation at birth of about 58 years. England itself falls only slightly below these figures, with an average of about 55 years; France, Germany,

Italy, and Japan before the war had expectations varying from 45 to 48 years, or about 10 years less than our own country. India stands at the very bottom of the list of the countries of the world, with an expectation of about 23 years.

These figures are the best basis of comparison we have for the well-being and prosperity of the nations of the world. Where life is long, debilitating sickness is less prevalent and economic production is highest. The extraordinary prosperity which has been witnessed in the United States is, in large measure, the result of the control which has been exercised over disease; of the freedom which men and women have attained to labor without interruption and without fear; the opportunity that our children have gained to grow up in the care of father and mother, amply supplied with the necessities of life and preserved from the trials and sorrows of broken families. Where, as in India, the duration of life is short, existence is surrounded by fear of death, and of crippling, and of invalidism. The capital spent in bringing up children is largely wasted because so few reach maturity to continue their full productivity for a period long enough to pay for themselves, with no thought of adding to the wealth of their country.

No greater service can be rendered to insure the general peace and prosperity than to improve the world's health. In this field of labor there are no international jealousies, but rather international obligations and opportunities. A low standard of health in any country is a menace to all its neighbors; in fact, to the whole world. It was because Europe and America were indifferent to the existence of influenza centers in Asia that this disease could later spread to all the world, causing more damage to life than the Great War. Prevention of disease and the prolongation of life for the people of India, for example, will bring prosperity to all the nations that have dealings with them; for the people of India will become better producers and, therefore, better customers for the products of the whole world. It is obviously, therefore, to the interest of the leading nations—those who have enjoyed greater advantages and opportunities in health work—to make available these advantages to those who are backward and to those who lack financial ability to institute progressive measures on their own account. The International Health Board, the Health Organization of the League of Nations, and those other bodies which function in international health service are at the very forefront in bringing nations together on a higher plane. Such work creates a better understanding between nations and increases mutual trust and respect. What concerns the health of the people touches, after all, the most responsive chord in the heart of mankind.

I wish to insert in the record a letter from Dr. Frederick L. Hoffman, who is statistician of the Prudential Insurance Co. of America. He is in close touch with vital statistics through his official connection with that great insurance organization. He calls particular attention to the alarming situation presented by the increase in cancer, its significance, and the necessity for concentrated attack on this problem. The letter follows:

THE PRUDENTIAL INSURANCE CO. OF AMERICA,
Newark, N. J., April 21, 1928.

Senator JOSEPH E. RANSDELL,
Committee on Commerce, United States Senate,
Washington, D. C.

DEAR SENATOR RANSDELL: To my sincere regret it will be impossible for me to appear before your committee in connection with the hearing on bill S. 3391, creating a national institute of health. I have very carefully read this bill and like the preceding proposed measure, it has my hearty indorsement. I have given this matter many years of thoughtful consideration and I feel strongly that public health would be profoundly promoted by such an institute, which would be able to command the services of specialists under different conditions than those that now prevail.

Speaking particularly on the subject of cancer research, with which I have long been connected, I realize profoundly the serious disadvantages of isolation and lack of means to prosecute distinctly hopeful lines of inquiry practically certain to prove productive of far-reaching results. Let me illustrate this by a concrete illustration.

Within recent years, mule spinners' cancer has been recognized in England as a distinct occupational affection. The claim was made time and again in British reports that this affection did not occur in this country. I was not satisfied with

the statements made and induced the division of vital statistics to furnish me with copies of all original death certificates covering the mortality from scrotal cancer during the year 1926. On the basis of these certificates I was enabled to clearly establish the fact that six unquestionable cases of mule spinners' cancer had occurred in this country, with a reasonable probability of more if means were available to prosecute this line of research to a larger conclusion.

Permit me to give another illustration. I have at present in my personal possession over 50,000 cancer death certificates, representing the so-called San Francisco cancer survey, which includes a number of other localities and sections in this country and Canada. The first four reports of this survey have been published through the courtesy of the Prudential. They reveal an amazing amount of new information, particularly as regards the known duration of the disease, differentiated according to organs and parts, illustrating the wide divergence in varying parts of the country. This immensely valuable material should be dealt with in a much more admirable manner and could be if reasonable assistance were forthcoming, particularly from governmental sources. I have also over three thousand questionnaires representing records of living cancer cases. A thorough analysis of this material is an arduous undertaking. I am practically alone in my efforts to manage this information to best advantage. Collateral inquiries urgently called for can not be made. If the truth of the cancer situation as revealed by statistics is ever to come to light, it must pursue some such lines of inquiry as have been developed.

Permit me to add to the foregoing a further illustration. I have approached the cancer situation from the negative point of view as regards localities or types of people apparently not subject to the disease or only to a much lesser degree than is common to the population at large. In this connection, I have made investigations in Mexico, West Indies and Russia and among our North American Indians. A paper on the last named subject will be presented on April 30 at the meeting of the Cancer Research Association to be held in Washington. But such investigations, to be of real value, must be carried on in the field by personal inquiry to make sure of the facts. Of necessity, I have largely had to concentrate my personal attention upon the Indians of the Southwest, with whom I am fairly familiar. Here again, the aid of governmental support would be invaluable.

I will take the liberty of concluding the foregoing by calling the attention of your committee to some cancer statistics just compiled by me for my annual review. I have tabulated in the first place the uniform cancer statistics for 23 American cities, which in 1927 had an aggregate population of about 22,500,000. The cancer death rate in these cities has increased since 1906 from 74.5 per 100,000 of population to 94.1 in 1917 and to 115.6 in 1927. This table is amplified by details for 132 American cities which in 1927 had a collective population of over 36,000,000. For these cities in 1926 the cancer death rate was 109.7, while in 1927, it increased to 110.9. Of the 132 cities, 32 had a rate in excess of 125 per 100,000, which must be looked upon as decidedly excessive. One city, San Diego, Calif., had a rate as high as 191.7, while the rate for Pasadena, Calif., was 178.5. Most of the cities showed an increase during the year over the preceding year and a substantial increase over the rate prevailing 10 years ago. I am decidedly of the opinion that the observed increase in the cancer death rate is real and not apparent or explained by improved diagnosis or otherwise. In New York State last year, cancer was the second most important cause of death. According to the commissioner of health of the State of New York, "Cancer, with the highest death rate yet registered, is now second in importance among causes of death. In 1926 it was third, in 1917 it was fifth, and 20 years ago it was eighth." Thus, the lamentable facts face the American public that this insidious disease is progressing at an alarming rate causing annually probably not less than 120,000 lives. Surely here, if anywhere, the Government has a duty which can not be discharged otherwise than by the adequate support of those who give their earnest time and thought toward a solution.

Pardon this lengthy letter, but I would like to go on and deal with other questions, but the foregoing, in my judgment, is the one of outstanding importance.

Very truly yours,

FREDERICK L. HOFFMAN.

I wish to insert in the record a letter from Dr. C. E. A. Winslow, who is connected with the public health work of the Yale School of Medicine and is convinced that through such research as is proposed

in this bill the span of life could be lengthened, and he favors most heartily the system of fellowships and the acceptance of gifts from individuals as proposed in this bill. The letter follows:

YALE UNIVERSITY, SCHOOL OF MEDICINE,
New Haven, Conn., January 26, 1927.

Hon. JOSEPH E. RANSDELL,
Committee on Commerce,
United States Senate, Washington, D. C.

MY DEAR SENATOR RANSDELL: I was greatly interested in your letter of January 13 and in a copy of Senate bill 4540, and in your admirable speech on this general subject. It would give me great pleasure to testify before your subcommittee, but unfortunately I am in the midst of preparations for a trip to Europe to give some lectures in Paris, and have been unable to find an opportunity to come to Washington.

I am very happy indeed, however, to express my very hearty approval of the bill which you have proposed. It is unquestionably true that the expenditure of Federal funds for the expansion of the work of the Hygienic Laboratory of the United States Public Health Service could reasonably be expected to result in the saving of life and the promotion of health on a scale far greater than that of the cost of such development. We know that the average length of human life has been prolonged by 15 years during the past century largely as the result of the developments of sanitary science and we know that at least 10 years more could be added to the span of human life by progress along the same lines.

The measures which you propose for the establishment of fellowships and for the concentration in the Federal health service of research supported by private agencies seem to me entirely sound and I earnestly trust that the bill may receive the approval of Congress.

Yours very truly,

C. E. A. WINSLOW.

I wish to insert in the record a letter from Dr. M. J. Rosenan, who is connected with the department of preventive medicine and hygiene of the Medical School of Harvard University. Doctor Rosenan stresses the necessity for increased amount of research work on the problems of health and commends most heartily the feature of this bill authorizing acceptance of gifts for the purpose of a national institute of health. The letter follows:

HARVARD UNIVERSITY MEDICAL SCHOOL,
Boston, Mass., January 29, 1927.

Senator JOSEPH E. RANSDELL,
Washington, D. C.

MY DEAR SENATOR RANSDELL: I think your bill (S. 4540) to establish a national institute of health, to authorize increased appropriations for the Hygienic Laboratory, andto authorize the Government to accept donations for use in ascertaining the cause, prevention, and cure of disease affecting human beings, comes very near hitting the nail on the head. This is just the sort of thing we need to make life surer, safer, and healthier. The conquest of disease depends upon the hard work of patient laboratory devotees who consecrate their lives to investigations in the laboratory, in the field, and at the bedside. There is no other method by which the information can be gained that is helpful in preventing or curing disease and prolonging life. Scientific investigators do their best work if they have an assured tenure of office and a reasonably satisfactory compensation, so as to give them that mental calm which comes when the material needs of life are satisfied. Scientific workers are sensitive flowers and do their best in cloistered seclusion.

I believe there are many persons who would be only too glad to give and give liberally to the Government for the purposes in question. It seems to me it is just the sort of thing that should be encouraged in this country to hasten constructive work for the welfare of all mankind.

Very truly yours,

M. J. ROSENAN.

I wish to insert in the record a letter from Dr. Herman N. Bundesen, who has been commissioner of health of the city of Chicago and presi-

dent of the American Public Health Association. He feels that the principles embodied in this bill are a national duty and obligation. The letter follows:

DEPARTMENT OF HEALTH,
Chicago, February 19, 1927.

Hon. JOSEPH E. RANSDELL,
Committee on Commerce, United States Senate,
Washington, D. C.

MY DEAR SENATOR RANSDELL: After due consideration of Senate bill 4540 I wish to indorse it very heartily. I do not consider it necessary to express my opinions at greater length than to say that it is a national duty and obligation that the Government appropriate and accept donated funds to be used in ascertaining the cause and the means of prevention and cure of diseases. The provisions of the bill are wise and sound.

Sincerely,

HERMAN N. BUNDESEN,
Commissioner of Health.

I wish to insert in the record a letter from Roy Lyman Wilbur, president of Stanford University, California. He commends all of the various features of the bill, points out in a striking way how progressive the Japanese Government has been in these matters, and states that in our Hygienic Laboratory and Public Health Service we have only made a beginning. The letter follows:

STANFORD UNIVERSITY,
OFFICE OF THE PRESIDENT,
Stanford University, Calif., January 20, 1927.

Senator JOSEPH E. RANSDELL,
Committee on Commerce,
United States Senate, Washington, D. C.

DEAR SENATOR RANSDELL: Thank you for your letter of January 13. I am sorry that circumstances are such that I see no opportunity for me to appear before your subcommittee of the Committee on Commerce.

I am in hearty sympathy with the purpose of your bill No. S. 4540, particularly since it would provide more adequate financial resources for the Hygienic Laboratory and would permit the acceptance of donations to establish a national institute of health.

The advance of scientific medicine is of most immediate significance to a people. I have recently come back from a trip in China and Japan; and I am attaching herewith a book on the Government Institute for Infectious Diseases, in Tokyo, indicating the way the Japanese Government has taken over a privately established institution and made it a part of the Government machinery. In fact they have a large building program in the Government schedule for this institute. I saw in it some of the most important research work in medicine that is being done in the world.

We have in America only a start with the Hygienic Laboratory and the Public Health Service. I am sure that the measures which you are taking will be productive of both thought and action. My hearty congratulations.

With best wishes to you, I am,

Faithfully yours,

ROY LYMAN WILBUR.

I wish to insert in the record a letter from Dr. Wm. H. Howell, who is the assistant director of the School of Hygiene and Public Health of the Johns Hopkins University. Doctor Howell has been instrumental in giving efficient training to many workers in public health. He approves most heartily the idea of an effective controlling center for investigating matters pertaining to health and diseases, both in the laboratory and in the field, and the appropriations asked for this purpose. Doctor Howell has unfortunately read into the bill more than it covers for there is not contemplated the establishment of a school of public health, such as he mentions. He feels that the crea-

tion of this national institute of health would be of great service not only in itself but in the coordination work throughout the country. The letter follows:

THE JOHNS HOPKINS UNIVERSITY,
SCHOOL OF HYGIENE AND PUBLIC HEALTH,
Baltimore, Md., January 20, 1927.

HON. JOSEPH E. RANSDELL,
United States Senate, Washington, D. C.

MY DEAR SENATOR RANSDELL: I must apologize for not replying more promptly to your letter of January 13 in reference to the bill (S. 4540) introduced by you in the Senate and bearing upon the establishment of a national institute of health. I gave myself a few days to think the matter over and to discuss it with some of my colleagues. I may say that the general idea underlying your proposal, as I understand it, has my heartiest indorsement, and I shall be very glad, if you desire, to appear before the subcommittee appointed to hold hearings on the measure.

Perhaps I may be allowed to express briefly to you my impressions in regard to the several features of the proposal. It seems to me that the main point is to develop an effective controlling center for investigation in matters pertaining to health and disease, both laboratory researches and the more extensive investigations of a field nature carried on in the community or in the industries. I approve the idea that such a project can be organized most efficiently under the Federal Public Health Service, and the proposal in section 7 to appropriate money for the enlargement of the hygienic laboratory and to provide generous fellowships for trained workers has my cordial indorsement. The work of this laboratory in the past has been most important, and it would seem wise to strengthen it by increased facilities and the creation of new departments of work. The system of fellowships would be useful in two ways: First, to attract promising young men and give them adequate training in research along these lines; second, they might be used to give known investigators of ability an opportunity to spend a year or more in Washington on leave of absence, in working out the special problems in which they were interested and which they were specially qualified to investigate. In other words, I would like to see the hygienic laboratory converted into a large research institute equipped to study the many problems of an immediate and remote character which are pressing for solution in the whole wide field of public health.

In regard to the proposal to establish a national institute of health I am not so clear. So far as it would serve as a center of research, that function would seem to be provided for by an adequate enlargement of the Hygienic Laboratory. The additional function of training young men for a career in public health, involving a professorial staff, courses, and diplomas, in other words the establishment of a school of public helath is, I believe, open to question. We have in this country now several schools for this purpose which are more than sufficient to meet the demand. In the school here, as in the one at Harvard, most of our serious students at present are from foreign countries, or from organized health departments, sent to us on fellowships from the Rockefeller Foundation. Relatively few of our own medical graduates are attracted to the career, owing, it is generally believed, to the fact that the positions for such men, State and municipal, are as a rule political, and subject to change with changes in administration. The uncertainty of tenure in such positions deters our young men from entering a career which intrinsically, I am sure, would appeal to many of them. We hope that in time these positions will be protected, as they are in Great Britain, and that only those men will be appointed who have had special training for the work.

Whether or not this is an adequate explanation, the fact remains that we have at present ample facilities for the training of medical and scientific graduates for careers in health work, and the establishment of another school, under the auspices of the National Government, is not urgently needed. For research, however, we need all the good men that can be obtained, and if the resources of our Government are used to promote our advance in knowledge, it is difficult to imagine any direction in which a great return might be expected in benefits to the people at large. A great research institute in health at Washington would be of immense service both directly in the work accomplished there and indirectly in coordinating similar work throughout the country.

Sincerely yours,

W. H. HOWELL.

I wish to insert in the record a letter from Mr. L. W. Wallace, who is the executive secretary of the American Engineering Council and gives unqualified indorsement of this bill. The letter follows:

AMERICAN ENGINEERING COUNCIL,
Washington, D. C., February 7, 1927.

Hon. JOSEPH E. RANSDELL,
United States Senate, Washington, D. C.

MY DEAR SENATOR RANSDELL: Please pardon my delay in replying to your good letter of January 13 with reference to your bill proposing to establish a national institute of health, etc. Since receiving your letter I have been under unusual pressure and have also been away from the office a great deal, which accounts for the delay.

I have very carefully studied your bill as well as the contents of your letter. You have indeed launched a broad, wholesome project. The idea in general I subscribe to fully and shall be glad to contribute as much as possible to its furtherance. You may, therefore, count upon my assistance in such directions as I can be most helpful.

Sincerely yours,

L. W. WALLACE, *Executive Secretary.*

I wish to insert in the record a letter from Dr. Haven Emerson, who is professor of public health administration in the College of Physicians and Surgeons of Columbia University. Doctor Emerson's name is known throughout the country as an outstanding worker in this field of public usefulness. He is in hearty accord with the proposal of increased research work of the Government on the question of disease, recognizing the benefits which would accrue therefrom not only to this Nation but to others, thus increasing his national good will. He considers that our present appropriations for such work are "pitifully inadequate" and thinks that the appropriations suggested in this bill are modest, and that they are only sufficient to "provide a nucleus for the kind of research in the interest of health the people of this country should have and would gladly pay for." The letter follows:

COLUMBIA UNIVERSITY,
COLLEGE OF PHYSICIANS AND SURGEONS,
New York, February 4, 1927.

Senator JOS. E. RANSDELL,
Senate Office Building, Washington, D. C.

DEAR SENATOR RANSDELL: Indorsements of the principles expressed in your bill S. 4540 must seem superfluous to any one familiar with the pitifully backward status of scientific research for preventive medicine in this country, and particularly as supported by our Federal Government.

Probably more benefit to human life, to material wealth, to national safety, to international good will, would be accomplished by generaous Federal and private endowment of research in the fundamental sciences, such as biology, chemistry, pharmacology, bacteriology than can be attained by any other investment of equal cost in money.

That the first step toward the goal you have in mind must be the passage of the Parker bill, H. R. 10125, is probably well known to you, for until there is coordination of the now scattered and costly, decentralized distribution, of public health functions among a dozen and more Federal departments and bureaus, as provided for in this bill under Executive order, the full power of scientific inquiry with the causes and means of preventing human disease can not be mobilized and held continuously in competent hands.

Of special importance are the provisions of this bill which put engineers, physiologists, chemists, biologists and other scientists on the same basis in appointment, advancement and other privileges as the medical personnel of the Public Health Service now enjoy.

Expansion of the facilities and resources in men and money of the Hygienic Laboratory, without loss of central direction and responsibility, can not go too far to suit the sanitarians of the United States.

There is no reason, except lack of understanding of the relation of the essential sciences to preventive medicine, for the pitifully inadequate, almost amateur, provision made by our Government for the study of disease, its causes and prevention.

If the name Hygienic Laboratory is unsatisfactory, though I see no reason to suggest such an idea, the proposed national institute of health may prove a more suitable one for the more expansive establishment you propose.

The appropriations you suggest are modest and will do little more than provide a nucleus for the kind of research in the interest of health, the people of this country should have, and would gladly pay for.

With best wishes for the rapid progress of your bill, S. 4540, to enactment into law, I am,

Very sincerely yours,

HAVEN EMERSON,
Professor Public Health Administration.

I wish to insert in the record a letter from Dr. Oscar Dowling, who is the president of the department of health of the State of Louisiana. His work is known throughout the Nation as of outstanding importance, through the safeguarding of the port of New Orleans and through the effective administration of public health service in that State. The letter follows:

JONESBORO, LA., *April 23, 1928.*

Hon. JOSEPH E. RANSDELL,
Unites States Senate, Washington, D. C.

DEAR SENATOR RANSDELL: I understand the hearings on your health bill before the Senate Commerce Committee will take place in the near future. I have been interested in your bill for a national institute of health from the beginning. Your measure is timely and if put into effect the results would be invaluable not only to our own United States but to the entire western continent.

I sincerely trust that the committee will hand down a favorable report.

With good wishes for your success, I am,

Very sincerely yours,

OSCAR DOWLING,
President Louisiana Department of Health.

I wish to insert in the record at this point a statement of Dr. Julius Stieglitz on the proposed national institute of health. Doctor Stieglitz is professor and chairman of the department of chemistry of the University of Chicago. The statement follows:

Life is maintained, from its inception to its end, through chemical and physical processes of great complexity and of extraordinary variety. In health these processes are normal and balanced; any irregularity in the chemical or physical changes produces in itself a diseased condition, and by lowering the resistance of the body organs (for instance the heart) to strains, and reducing the normal resistance of the body to the attack of invading microbes, such irregularities in the chemistry of the body prepare the ground for the most dangerous of diseases.

At the same time, although our bodies function every moment of our lives as chemical and physical machines, there are certain important life factors which the physical sciences as yet have been unable to explain or duplicate: Thus, life is produced only by life itself and continues only from generation to generation; the physical sciences, thus, can not produce life but can only foster and protect it. This elemental fact is only an illustration of the many ways in which life forces, still of an obscure character, control life, health and disease. The biological sciences study these life processes at first hand and it is to the various sciences of the biological group, medicine, pathology, bacteriology, pharmacology, etc., that the chief care of the preservation of health and the prevention of disease must be committed.

It is evident, however, since life processes are so largely chemical and physical in character and subject to the laws of chemistry and physics, that progress in medicine and the other biological sciences must depend in a very large measure on the extent to which the medical investigators and the biologists in general can have the aid of the physical sciences in the attack on their problems. This means that the greatest promise for successful solution of the outstanding problems in medicine, on which the prolongation of life of millions depends, is to be

expected from intensive cooperation between leaders in the various sciences in question—namely, cooperation of the physician, the physiologist, pharmacologist, bacteriologist, and pathologist of the biological sciences on the one hand, and the chemist and physicist on the other hand. This connection between progress in medicine and chemistry and physics is now very widely recognized and medicine is calling more and more on these fundamental sciences for cooperation in the solution of its difficult problems. Thus, the invaluable discovery of insulin, used to protect and prolong the life of diabetics, was the result of cooperative effort of a small group of men representing medicine, physiology, and chemistry. The successful work of the late Doctor Howland, of Johns Hopkins University, on the cure of rickets owed its success in large measure to active participation of physicain and chemist in the investigations under a single leadership.

Universities and certain research institutions often have all of the above branches of science strongly represented in their staffs, but except in the rarest of cases, there is no intensive cooperative attack on a single problem by all of these scientists working together. There is rather scattering of effort on different problems in which the individual men are individually interested. Conferences and incidental advice and exchange of ideas no doubt are helpful in such institutions, but the fact remains that united attack on a given problem as the major interest of leading men in the several sciences involved, is of the rarest occurrence, if it occurs at all.

It is in this direction that the United States Government, through the establishment of a national institute of health, has the unique opportunity to give to our country a new and powerful weapon for attack on the great problems of maintenance of health and cure of disease, which is not duplicated or equaled elsewhere. If in the appointments to the staff of such an institute two principles shall be observed—first, that leaders in each field shall form the main staff, and second, that the whole staff shall devote itself primarily and unitedly in the attack on individual large problems, the most powerful organization ever developed for the solution of these problems will result. It will show greater promise for ultimate success than anything ever attempted before this. Such carefully planned, organized effort on the part of leaders in the several fields would be comparable with carefully planned, organized effort embracing all the various weapons of defense and offense of a nation called upon to defend itself in war. United effort of the Navy, the Infantry, Artillery, Cavalry, Air Service, etc., is now the self-understood method of campaign against an enemy. Similarly, a campaign against disease, against invading microbes and disorganized body functions will give the greatest promise of success in an institution that can continuously call upon eminent men in the fields of science studying disease to give their whole service to the planning and execution of the campaign against these deadly enemies to the life of our people.

Among the diseases which could be effectively investigated in such an institute the following may be stressed as levying the heaviest toll of lives and toward the cure and prevention of which only the beginnings of progress have been made thus far: Tuberculosis, pneumonia, influenza, cancer, septicemias caused by streptococcus and staphylococcus, heart disease. The extraordinary progress made as the result of years of difficult research by all the allied branches of science the cure and prevention of such widespread diseases as yellow fever, syphilis, the hookworm, diphtheria, scarlet fever, diabetes, etc., holds out the positive promise of ultimate success in the control and cure of the diseases enumerated above in which so little positive progress has as yet been made. Every year that the solution of these problems is hastened means life and happiness to millions.

I wish to insert editorials from the New York Times, Indianapolis Star, and the Montclair (N. J.) Times, indorsing this bill, and urging greater appropriations by Congress or research in behalf of human beings. The editorials follow:

[From the New York Times, April 12, 1928]

MEN, ANIMALS, AND PLANTS

Doctor Herty, of the Chemical Foundation, in an address in Washington last night called attention to the meager support given by the Federal Government to research studies relating to human health as compared with that voted for studying diseases of plants and animals. More than $13,000,000 was expended last year in fighting plant diseases and pests and more than $8,000,000 in com-

bating diseases of animals. The pitiful sum of $43,000 is asked this year—about the same as last—for the research department of the Public Health Service, which has to do with human beings.

It is estimated by the Public Health authorities that practically 50,000,000 people suffered last year from colds and bronchitis; 17,000,000 from influenza and grippe; 11,000,000 from diseases of the digestive system; 8,000,000 from tonsilitis and sore throat and 5,000,000 from diseases of the nervous system, and so on through a long list of diseases which may be brought under control through intensive study. But the Government, while spending not too much for defense against the enemies of plants and animals, is spending virtually nothing for defense against what brings the greatest economic loss as well as the greatest discomfort to mankind. At present the conservation of the health of the Nation is left almost entirely to private interests and to such spasmodic provision as the States or cities may make. It is time that the people as a whole gave attention to the conditions with which even the most generous private foundations can not cope and which in their ravages leap over city limits and State boundaries.

A bill has been introduced in the Senate by Senator Ransdell, of Louisiana, providing for the creation of a national institute of health within the Public Health Service for the specific purpose of setting a large group of scientists "to work uninterruptedly upon the fundamental causes of sickness, disease, and premature death." It is proposed that $2,000,000 a year be appropriated for a term of five years for the maintenance of a chemicomedical research laboratory. Even so we shall not be giving the health of men, women, and children as much governmental attention as we give to that of cattle, hogs, sheep, horses, and plants.

[From the Indianapolis Star, April 15, 1928]

ATTENTION TO HUMAN WELFARE

A bill has been introduced in the Senate by Senator Ransdell, of Louisiana, providing for the creation of a national institute of health within the Public Health Service and proposing that $2,000,000 a year be appropriated for a term of five years for the maintenance of a chemicomedical research laboratory. The plan will permit a body of scientific men to work without interruption on the fundamental causes of sickness, disease, and premature death. The sum may seem large at first thought until it is compared with the amount which the National Treasury has provided for research into plant and animal disease. Mere man has been compelled to rely almost wholly on private investigation.

No one questions the value of the service rendered in improving the country's economic standing by discovering means to overcome plant pests or to improve the health of stock. In comparison with the $10,000,000 sought for the benefit of the American people over a five-year period, it should be noted that more than $13,000,000 was spent last year alone in combating plant pests and more than $8,000,000 in overcoming animal diseases. If plants and animals require more than $21,000,000 in a single year from Federal appropriations, it would seem that the physical and economic welfare of human beings should warrant the expenditure of one-tenth of that amount.

Hundreds of millions are lost annually through the impairment of workers' efficiency by disease in spite of the advance which has been made in national, State, and private health campaigns. It is estimated by the public-health authorities that 50,000,000 people suffered from colds and bronchitis last year; 17,000,000 from influenza and grippe; 11,000,000 from diseases of the digestive system; and additional millions from nervous and other disorders. Apart from the Senate bill referred to, the Public Health Service has asked the insignificant sum of $43,000 for research in human ills. The work should be as important as the eradication of black rust or hog and cattle diseases.

[From the Montclair (N. J.) Times, March 7, 1928]

FAVORS HEALTH INSTITUTE

Members of the Montclair Engineering Society at their meeting in the art museum on Friday night were told about the need for a national institute of health operated under the jurisdiction of the Secretary of the Treasury, provision for which is made in a bill that has been introduced in the United States Senate by Mr. Ransdell, of Louisiana. This bill would authorize an appropriation of $10,000,000 to carry out the provisions of the act. It would also facilitate the acceptance of funds donated by individuals to further health-promotion work

by the Federal agency. The local society went on record as approving the measure, after the speaker of the evening, Dr. Charles Herty, of the Chemical Foundation, had told of some of the benefits that would be derived from the establishment of a national health-institute. The Government now spends millions of dollars annually in promoting the health of cattle and conserving the natural resources of the Nation. It is not unreasonable or illogical, therefore, to propose that it devote a like sum to a study and investigation of the causes of those diseases which annually kill more human beings than were wiped out in any single battle of any war in which this country has ever engaged. The enormous economic loss occasioned by preventable sickness and death is sufficient in itself to warrant even a more substantial draft on the National Treasury than is proposed by the Ransdell bill if the expenditure of money will be effective in curbing disease and lengthening life.

I wish to insert in the record a telegram received from Dr. Rudolph Matas, of New Orleans, who is one of the best known physicians and surgeons in the South. His unqualified indorsement of S. 3391 is entitled to great weight. The telegram follows:

NEW ORLEANS, LA., *April 27, 1928.*

United States Senator JOSEPH E. RANSDELL,
United States Senate, Washington, D. C.

I deeply regret that your letter was unfortunately lost with other mail and was not read. I am familiar with your bill to establish national institute of health and wish to be put on record as one of its enthusiastic supporters. I am in hearty sympathy with its fundamental principles and believe that this country should lead the civilized world in fostering, utilizing, and maintaining all Government agencies in a thoroughly coordinated effort to investigate the problems of disease and promote the public health.

R. MATAS.

I wish to insert in the record at this point a copy of a resolution passed by the Louisiana State Board of Health at New Orleans, La., on April 25. The resolution follows:

Whereas the bill to establish a national institute of health, to authorize increased appropriations for the Hygienic Laboratory, and to authorize the Government to accept donations for use in ascertaining the cause, prevention, and cure of disease affecting human beings, introduced as S. 4540 by Senator Ransdell will provide much needed facilities for protection from disease and for the promotion of health; and

Whereas, the Louisiana State Board of Health in regular session assembled has considered the scope and purpose of the proposed Institute of Health and believes it would encourage investigations in the sciences and arts of hygiene, medicine, and surgery, and allied subjects, in the nature and causes of disease and the methods of its prevention and treatment, and to make knowledge relating to these subjects available for the protection of the health of the public and the improved treatment of disease and injury; therefore, be it

Resolved, That we commend this bill and the efforts of Senator Ransdell and urge that the representatives of Louisiana use their influence that the national institute of health be established.

I wish to insert in the record a letter from Dr. John J. Abel, who is the head of the department of pharmacology of the Johns Hopkins University, and one of the most eminent scientists in America. The letter follows:

JOHNS HOPKINS UNIVERSITY,
SCHOOL OF MEDICINE,
Baltimore, Md., April 27, 1928.

Senator JOSEPH E. RANSDELL,
United States Senate, Washington, D. C.

DEAR SENATOR RANSDELL: I have carefully studied the provisions of the bill introduced by you (S. 3391) to establish a national institute of health, to authorize increased appropriations for the Hygienic Laboratory, and to authorize the Government to accept donations for use in ascertaining the cause, prevention, and cure of diseases affecting human beings, and for other purposes.

I wish to give my unqualified and whole-hearted approval of this measure. From all points of view there is an urgent need for a national institute along the lines outlined in your bill. Many problems relating to the health and well-being of our people that are quite beyond the facilities of the existing institutes of this country could be studied with every prospect of success by a central institute of this type. Other countries much more heavily taxed than our own have recognized the urgent necessity of establishing and adequately maintaining institutes of this character, and certainly we should not lag behind other nations of projects of this nature which will not only benefit our own people, but those of the whole world.

There can be no question as to the incalculable benefits that will follow the discoveries that it may confidently predict will be made in the years to come by the corps of selected and highly competent investigators such as would naturally be appointed to serve the Nation in a great institute of the character contemplated by your bill.

I close with the ardent hope that the legislative and executive authorities of the Nation will see fit in their wisdom to give actuality to the measure with its boundless possibilities for the physical and mental welfare of our people.

Very sincerely yours,

JOHN J. ABEL.

I wish also to insert in the record a statement by Dr. William J. Mayo, of Rochester, Minn., read before the American Chemical Society, St. Louis, Mo., April 17, 1928. The statement follows:

THE ADVANCEMENT OF LEARNING IN MEDICINE THROUGH BIOCHEMISTRY

(William J. Mayo, Rochester, Minn.)

[Read before the American Chemical Society, St. Louis, Mo., April 17, 1928]

I shall take for my subject to-night the inspirations which have come from the scientific contributions of two men who worked in the early part of the Victorian Age—pioneers who shed light on matter and energy and on man.

John Dalton, chemist and physicist, professor in Owen's College, England, which is now the University of Manchester, working with so few instruments of precision as to be the marvel of the scientific world, laid down the principles of chemical research in the second, third, and fourth decades of the nineteenth century. This outstanding personage appeals to me greatly. My father was a student of Dalton, and when my brother and I were small boys, he told us much about this tall, gaunt, awkward scholar, the keenness of his intelligence, his modesty, and how little it was realized in his day that the atomic theory was more than the vagary of a scientist. Dalton outlined the atom as the ultimate particle and his concept stood until the work of recent investigators showed that the atom was composed of protons and electrons. The 1928 model of the atom is presented as being largely a vibratory phenomenon. Dalton visualized the molecule as the ultimate particle that contained the characteristics of the mass.

Brown, the English botanist, a near contemporary of Dalton, in 1827 had described the dancing motes which could be seen in the air of a dark room under a pencil of light and also were visible in certain fluids with the aid of the microscope. The vibratory motions of these motes were first called brownian movements and later, in connection with the work of Dalton, were described as "the dance of the molecules."

It was not until 1861, when Thomas Graham, master of the mint in London, showed that these so-called light motes were reflections of light from actual minute structures which, although invisible to the eye, were large enough to interrupt a a ray of light, but were too large to pass through a parchment filter, that the field of colloids was opened.

Tyndall called attention to the curious phenomenon occurring in the track of a luminous beam (the Tyndall phenomenon), one form of which is the effect of sunlight on colloids in the air, and investigated the transparency and opacity of gases and vapors under radiant heat. He popularized the colloidal field by explaining beautiful sunsets and clouds as the effect of the changing temperature of the upper atmosphere on unseen forms of water.

Because of their minuteness, electrons, atoms, molecules, and, to a large extent, colloids are not affected by gravity and remain in rapid motion more or less permanently suspended in their medium, although under certain conditions they

are affected by pressure, temperature, and atmospheric conditions. The behavior of water is an illustration of this property. Water exists in the atmosphere, but under certain conditions it does not feel the pull of gravity. Under specific atmospheric conditions, however, as when the water vaporises to a height in which the air is rarefied and is colder than at the point of evaporation, it gathers together in colloid form as clouds. For rainfall of an inch and a half it has been estimated that 144 tons of colloid water practically unresponsive to the pull of gravity are suspended over each acre; if the change from a dispersed to a fluid state takes place rapidly, the electrical energy on the surface of the colloidal particles is given off as thunder and lightning.

The colloid field to-day presents the most promising realm in medical research. One perhaps would not be far wrong if one said that in the colloid bodies life itself resides. From this small beginning the whole scheme of catalytic action and synthesis was developed which through the wonders of chemical research has given almost superhuman powers to man.

Chemistry represents the science of the composition and transformation of matter, and since chemical changes are dependent on physical conditions it leaves scarcely a line between physics and chemistry.

Day by day a new conception of medicine brings forth basic facts which enable us to look on man as a chemical unit almost as capable of analysis as material in the test tube. The study of vitamines, of hormones, of endocrines, and the electric concept of the nervous system are but a few of the outstanding investigations which are too recent for analysis.

As the trend in modern industry is toward the development of new combinations from the breaking down of the old, so in medicine similar fundamental changes are taking place. Industry has the advantage that in its experimental work it deals with replaceable materials; medicine must depend to a considerable extent on animal experimentation. To have value, animal experimentation must of necessity be carried on with the same humane care as surgical and medical procedures on the human patient; otherwise the experiments would be inexact and therefore worthless. It is a pity that so many well meaning people have allowed themselves to be swayed by fallacious statements into giving aid to an active band of so-called antivivisectionists. Without real knowledge these misguided people throw every possible obstacle in the way of scientific advance in the prevention and cure of disease, and their very honesty makes them difficult to cope with. Even more unfortunate for future progress in medicine are the moneys left to establish foundations in perpetuity for such shortsighted purposes; ultimately these foundations support human parasites who, not by reason of their present opinion on the subject, but because of their job, interfere with humanitarian movements at practically every session of every State legislature. It is a curious fact that among the opponents of animal experimentation are some ardent hunters and fishermen. It is a still more curious point of view that permits antivivisectionists to shoot game and to leave to a lingering death from wounds and starvation the injured birds and animals which they fail to bag, and to look with delight on their catch of fish slowly dying in a basket or on a string.

It seems a far cry from the work of Dalton to that of Charles Darwin. Last summer, when I visited Shrewsbury, England, it was my pleasure to lay a wreath at the foot of Darwin's statue in front of the school where he spent his working days. Darwin, in that remarkable series of deductions to be found in his "Origin of Species," laid the foundation for the practical study of evolution through investigations of embryology and comparative anatomy. His investigations concerned that which could be seen with the eye, or the eye aided by the microscope, as compared with the ultramicroscopic field of Dalton's endeavors. Dalton was interested in the undifferentiated material from which all life developed. Darwin saw man as a whole and determined his place in the animal kingdom. Darwin undertook to solve the problem of changes in the animal kingdom, to link up all those manifestations which were produced by a changing environment. He sought to prove that adaptations were for the general purpose of obtaining food, either because of the changing character of the food itself, as from the sea to the land, or for self-protection against other organisms which were attempting to convert to their own use the same nutritive material.

The most valid criticism of Darwin's theory rested on the fact that he was unable to show changes in the germ plasm. The possibility of such changes has now been proved, notably by the excellent research of Muller on the effect of X ray on the gene cell, presented before the last meeting of the American Association for the Advancement of Science. Muller pointed out that so-called

sports or mutations from which new species sprang could be produced artificially by radiation of the chromosomes and that the genes which carry the hereditary characteristics, when so changed, would reproduce the mutations.

The easily recognized and obvious enemies of man are not numerous, beasts and serpents, storms and earthquakes, but his less conspicuous and his microscopic enemies exist by the millions. The fight between man and parasites is a battle to the death for food, because insects, protozoa, and bacteria have essentially the same food necessity and were at home on the globe millions of years before man. Dr. L. O. Howard, chief of the Bureau of Entomology of the United States Department of Agriculture, reports that there are 2,000,000 varieties of insects in the world of which 600,000 have been studied. When we study the disease-causing bacteria, we gain a glimpse of the extraordinary work of Pasteur and its application by Lister to the prevention and cure of contagious and infectious diseases. The scientific contributions of Pasteur and Lister have prolonged the average length of human life more than 20 years and have proved to be man's greatest gifts to man.

CHEMISTRY AND METABOLISM

Medicine from its origin has attempted to cure or ameliorate disease by combating its gross manifestations. More recent investigations show that minor changes in underlying biologic conditions permit such gross manifestations to take place. Thus uric acid is increased in the blood and tissues before it is laid down as visible tophi.

When our remote ancestors came up from the sea they carried with them two powerful essential needs whose influence is manifest to-day: These were a mechanism for the maintenance of an acid-base equilibrium, and iodine.

The proper mineral balance insures the proper acid-base equilibrium. Mineral acid is not produced in any gland in the human body. In this connection we think at once of the hydrochloric acid of the stomach, but it has been shown that the necessary chemical elements for the production of hydrochloric acid are brought together in the acini of the glands, and that it is not formed in the substance of the glands. The acidity of the large intestine is the result of bacterial action.

The essential alkalinity of the bodily tissues is slight. It is comparable to the difference between ordinary tap water and distilled water, and at that, the distilled water must be fresh or it will absorb acid from the carbon dioxide in the air. An excess of alkali in the body (alkalosis), is now known to have as serious an effect as diminution of alkali, badly named acidosis; an acid reaction in the blood is incompatible with life. The recognition of these changes and their influence on metabolism is now one of the important factors in the estimation of the physical condition of man.

The second of the profound chemical necessities of the body is iodine. Iodine in almost infinitesimal proportions is contained in sea water. Sea plants have the faculty of removing the iodine and concentrating it, and one of the sources of commercial iodine is the kelp from the sea. Through the thyroid gland, iodine compounds act as a pacemaker of the bodily output of energy, and hence regulate nutrition of the human body. Iodine compounds, as exemplified by thyroxin, isolated by Kendall, act on the speed of combustion. Iodine and salt, coming as they do in concentration from the sea, are so soluble that they are quickly washed out of the soil. In certain geographic situations, for instance, the mountains of Switzerland, the poverty of iodine in the soil is shown in a high incidence of goiter, which is often manifest in the second, third, and later generations as dwarfing and cretinism. In a survey in the vicinity of Christchurch, South Island, New Zealand, it was found that 85 per cent of the girls in a large seminary which I visited were suffering from goiter, the result of idodine deprivation. Investigation of the water supply of Christchurch showed that the water was drawn from soil without essential iodine resources. It is worthy of note that among the Japanese, who live on islands surrounded by the sea, and who use a great deal of sea food, both plant and animal, goiter is extremely rare.

From the sun's rays certain wave lengths are stored as vitamines, of which five have been classified, and there is a growing wealth of knowledge as to their vital necessity. Cholesterol, a lipoid found largely in the bile, apparently is a vitamine precursor. When cholesterol is irradiated, it furnsihes vitamine D, a specific cure for rickets, to an even greater extent than does cod-liver oil. Liver is another substance which stores vitamines and other chemical necessities and it is now found valuable as an article of diet in pernicious anemia and certain other

diseases. Two hundered years ago the great navigator, Capt. James Cook (1728–1779), was the first to recognize that scurvy, the scourge of long sea voyages, could be prevented by eating fresh vegetables and fruit, which, as we now know, contain vitamine C, stored by the action of chlorophyl of plants. In recognition of his work on scurvy, Captain Cook was made a Fellow of the Royal Society of England and was given the Copley Medal.

The introduction of fire had much to do with the supremacy of man. Applied to food, heat breaks up indigestibe compounds, converting them into nutritivet foods, and destroys parasites of disease, but unfortunately at the same time it destroys or reduces in value vitamines and protoplasm. This reduction in food values attendant on cooking is now counterbalanced by properly selected diet including safe uncooked foods, or foods heated to a point sufficient to destroy germs of disease, but without destruction of vitamines, as in the Pasteuriztion of milk.

The failure to secure sufficient and proper food, influences greatly not only the physical but also the mental development of man. The Chinese look backward rather than forward, and yet, as they have been able to meet nutritional necessities and have survived by Darwinian adaptation, they have developed a resistance to deprivation diseases, to bacterial infections, and to living on a low grade of nutrition under conditions in which the occidental races in competition would perish. The resistance of the orientals to filth diseases is little short of marvelous. They have accomplished this, however, at the loss of some of the keener mental processes, especially in the marshalling of deductions from past experiences, which has been called intuition or the sixth sense. So lacking is the sense of responsibility for progeny among the oriental races that the only control of density of population is the starvation limit.

The American Indian in his earlier history was a nomad, moving frequently, a subconscious adaptation to escape the filth of long habitation, as well as to secure a fresh supply of game food. Later, when confined to more permanent dwellings, before general hygiene was brought to him, the Indian died because he had even less resistance than the white man.

It is probable that neither prohibition propaganda nor an appeal to the conscience of man has caused the rapid advance of the temperance movement, but that pure water has made this possible. It is assumed that the drinking of spirituous and fermented liquors is due to an evil inborn longing, to be stamped out only by the exercise of individual self-control. Is this true? In France and Italy the drinking of billions of gallons of wine saved the people from extinction; they could not have lived had they drunk their polluted water.

The Teutonic countries turned to beer to secure a sterile drink; England had ale and wine, and temperance counties, such as Turkey, had tea and coffee. Simultaneously with Vienna's introduction of a pure water supply from the mountains, her per capita consumption of spirituous and fermented liquor was reduced spontaneously 40 per cent. The introduction of a pure water supply in the various States in our country has been followed by a temperance movement, and finally by prohibition. The same influence is now apparent in Europe. In England pure water is to be had in the large cities, and a temperance movement promptly results, but in the villages without potable water no such movement is as yet manifest. The drink habit was one of the many forms of protection resorted to by nature to save man from filth diseases which cause death, or that which is worse than death, intellectual deterioration. Prohibition outlawry is largely from the alien who comes from countries where water could not be used for drinking purposes and also, of course, from the dregs and froth of our own citizens.

It is interesting to know that long before we understood the importance of the chemistry of nutritional physiology, we had an example of its empiric application on a large scale during the Civil War.

One of the greatest commanding officers of the Civil War was "Stonewall Jackson," who, with a small army, was able to march his troops so rapidly in the region across the Potomac from Washington that they were called "foot cavalry." He accomplished this by marching the soldiers several hours, then having them lie flat and relax for a few minutes. By resting in this manner the lactic acid, which accumulated in the muscles during action and produces fatigue, is in large part restored to glucose, as Hill and Meyerhof have shown. The soldiers then were given whatever food the sutler wagons afforded, usually carbohydrates, with fluids; this quickly supplied the necessary sugar, and they were again marched a shorter distance, with another period of rest and similar restoration. By repeating this process at intervals, Jackson was able to move

his ragged barefoot men over bad roads as far as 40 miles in 24 hours, and have them in fighting condition. One might say that Jackson prolonged the Civil War two years; he was able to keep Washington in fear of capture, forcing McDowell's army to remain on guard, instead of aiding the offensive on Richmond.

One frequently reads estimations of the number of inhabitants to whom the earth can supply nutritional needs. In making these estimations the pastures of the sea with their unlimited supplies of food should not be forgotten. Nutritional needs affect the plants and animals of the sea just as they affect man, and studies are being made of the reasons why certain forms of sea life exist in one locality and not in another. The depth of the penetration of light, the character of the soil of the sea, which may fail to develop the plankton on which fish live, become an important study which in succeeding generations will necessitate careful consideration, that the resources of the sea in their value to man may by cultivation be brought more nearly to resemble those on land.

BIOCHEMICAL PHASES OF OXIDATION

The fundamental combustion characteristic of man is the necessity for oxygen. The oxygen of the blood when liberated as a gas is equal to from 18.5 to 20 per cent of its volume, and in the carrying of this oxygen one or more atoms of iron to each molecule of hemoglobin is necessary. In the higher forms of life oxygen deprivation has been an important factor in evolutionary adaptations. Here again, medicine is just beginning to understand the relation of oxidative processes in the resistance to disease. To-day, in conditions in which the capacity of the lung is temporarily reduced so greatly that sufficient oxygen can not be taken in at this 1:5 ratio, the inhaled air can with proper apparatus be replaced with oxygen to above 60 per cent. The number of lives that are saved directly thereby and the understanding of disease processes which the oxygen deprivation permitted to become established, is one of the newer triumphs of biochemistry, which leads to the evaluation of some extraodrinary disturbances of which medical science previously had had no conception.

There are two theories of combustion, the iron-activation theory of oxidation of Warburg, and the activation-of-hydrogen theory of Wieland. In his address at a recent meeting of the International Physiological Congress, Hopkins said that fundamentally the two theories are not necessarily antagonistic. He gives the weight of his authority to Wieland's theory as best explaining the chemistry of biological processes.

Hydrogen, except under peculiar circumstances, presents itself in molecular form. The energy which is required to bring about molecular dissociation remains latent, and re-formation of the hydrogen molecule results in the escape of the power and energy that was necessary to separate it.

It is worth while to consider how combustion is normally controlled. A pound of sugar burned outside the body at a comparatively high temperature, above 400° C., produces the same amount of heat and energy as if oxidized inside the body at the temperature of 37° C. The chemist has long searched for an explanation of this phenomenon. Recent excellent researches in chemistry by Abel, Kendall, Banting, and Hopkins have indicated that there are certain catalysts which control combustion in the body, epinephrine, thyroxin, insulin, and glutathione. Some of these, as glutathione and insulin, contain an atom of sulphur within their molecule. Biological oxidation is held at normal through chemical regulators which contain sulphur, iodine, and nitrogen. Investigations in inorganic chemistry have shown that the oxidation of iron is largely due to the sulphur contained in the iron. Steel, freed from sulphur by newer processes of smelting, is practically rustless.

Three types of food are oxidized in the body: Carbohydrates, fats, and proteins, and with these foods mineral salts must be combined. Carbohydrate is burned in the form of glucose; the oxidized carbon is passed off as carbon dioxide in respiration, the oxidized hydrogen as water. The animal fats, of which tristearin is most common, are all quite similar in composition, being composed of stearic acid, which contains carbon, hydrogen, and oxygen combined with glycerin. Fats are oxidized much more slowly than glucose, by reason of the small oxygen content, but produce two and a half times as much heat and energy as carbohydrates and proteins by reason of their greater carbon and hydrogen content; they therefore produce more water as well. This is exemplified in certain hibernating animals during hibernation, when their bodily functions, as that of the kidneys, are suspended, the temperature of the body drops to about half the normal, and the water, so necessary to life, as well as heat and energy, is furnished

by the combustion of the autumnal fat. If we analyze the proteins, we find the presence of carbon, hydrogen, and oxygen as in the sugars and fats, and, also, nitrogen, which permits the deposition of form-producing mineral elements, such as phosphorous and calcium. There is also in protein a little sulphur.

The study of combustion in the human body, as far as the union of the carbon and the oxygen is concerned, and its expulsion by the lungs as carbon dioxide was easy, but the fact that hydrogen is the process of combustion develops water which is used in the system is not so clearly appreciated.

It is interesting that the molecule in animal or vegetable fat always has an even number of atoms which are oxidized in the body two at a time. When the carbon atoms are burned down, for example, to four, if sugar is not available for further combustion, diacetic acid or acetone is formed, and coma may result. If the molecule of fat contained an uneven number of carbon atoms which burned two at a time the low point would be five, at which valeric acid would result, or three, at which lactic acid would result, both harmless. An attempt to produce fat with an uneven molecular composition has been successful in a chemical sense, but unsuccessful from the physiologic standpoint, in that the body seems to be unable to metabolize such artificial fats. If glucose is not obtainable from ingested carbohydrates or proteins, and the stored glycogen in the liver is exhausted, glucose can only be obtained by breaking down the deposit or tissue proteins. About 58 per cent of these proteins can be converted into glucose, but the process liberates into the bloodstream an excess of nitrogen compounds, of which urea is the most important, and disorders result, not only from acetone, but from the rising tide of toxic products. Nowadays diabetic coma, formerly so greatly feared by physician and surgeon alike, yields readily, almost specifically, to insulin. A properly regulated diet, with judicious employment of insulin and glucose solution renders the patient with diabetes a good surgical risk in the majority of cases.

BIOCHEMICAL FACTORS OF IMPORTANCE TO CANCER RESEARCH

We know that cancer in its inception is a local disease and when in this stage can be cured by removal. The early signs and symptoms of cancer, however, often are slight or, when the disease exists in certain situations, are as yet undetectible. There is, I believe, an important chemical phase of the cancer problem as yet untouched, and I hope that in this audience of chemists there are those who will give careful attention to the chemical aspects of this scourage.

The adaptation for nutrition concerns the process of oxidation. Life is maintained by combustion, a molecular exchange in the colloids of the cell. The oxidation of carbon and hydrogen within the body, which gives rise to heat and energy, is the outstanding feature of all animal life, but while the normal cell functions within normal limits, the cancer cell oxidizes without control and without function. The analogy between the growth of the fertilized ovum and the growth of cancer has often been pointed out. The growth of the one, however, is orderly and with purpose, of the other disorderly and without purpose. The nearest approach of normal tissue to the conditions under which cancer develops is in the decidua of a pregnant uterus. Loeb, in 1905, showed that the process of natural fertilization of the sea-urchin egg could be imitated. From his researches he was able to show that the essential effect of natural or artificial fertilization is a calling forth of oxidations in the egg.

Uncontrolled combustion of food material is the most important feature of the growth of cancer.

The cancer cell in proportion to its malignancy has an increase of nuclear tissue; if the nucleolus is of normal size the increase in nuclear tissue signifies increased growth, but of normal, functioning cells. But if the nucleolus is unduly enlarged, there will be no function, and this is true in the cancer cell.

Just what part does the greatly increased size of the nucleus and the nucleolus play in the development of cancerous growths? It would appear by deduction that the nucleus controls the oxidation of the cell, but that the nucleolus enables the diseased cell to obtain nutrition at the expenses of the normal cell.

The degree of malignancy appears to depend on the profundity of the changes in the nucleus and nucleolus of the cancer cells as compared with the normal cells of the same tissue. The more nearly the diseased cell resembles the normal cell, the lower the grade of malignance. The establishment of this fact enabled the method of immediate diagnosis by microscopic examination of the frozen section to be developed by Wilson, MacCarty, and Broders, which is one of the greatest gifts that has been made to modern surgery. By means of microscopic examina-

tion of the frozen section it can be determined within two minutes whether or not the disease is cancer and also the degree of malignancy of the disease, so that the surgeon can act accordingly during the progress of the operation.

It is interesting in this connection that keratin, which is a highly sulphurized substance, is sometimes found in cancerous tumors, usually in the form of a hyalin compound, which indicates reduction of the malignancy. Demonstration of the catalytic action of certain sulphur compounds in the control of oxidation may explain a chemical phase of cancer development.

Carrell, in his beautiful experiments in which he compares normal fibroblastic tissue which he has had growing in a glass chamber for 15 years, with growing fibroblastic tissue from the cancer of fowls, shows that the malignant fibroblastic tissue grows more rapidly and that the growth is surrounded in its advance by acid medium. Here may be drawn a comparison between fowl cancer and the crowngall cancer of plants, on which the late Dr. Erwin Smith contributed some of the most interesting data extant on the study of cancer.

Warburg, in his valuable research on cancer, pointed out its extraordinary glycogenic action, but noted that there is no corresponding increase of respiratory carbon dioxide. He believes that much of the abnormal power of cancer cells may be due to fermentation, such as occurs normally in plants, for example; the action of yeasts.

Only 10 per cent of the general population suffers from cancer. We may assume that this incidence is not accidental, but that 90 per cent of the people are more or less immune to the cause or causes of the disease. Perhaps immunizing methods may be developed by chemical research that will establish effective resistance of the 10 per cent to the disease, as has been accomplished in smallpox, diphtheria, and scarlet fever.

Life is largely a matter of chemistry. The advancement of medical science began with those things which could be seen with the eye, or the eye aided by the microscope, and has now progressed into the ultramicroscopic field of chemistry. In its modern conception, therefore, medicine has become a branch of applied chemistry.

(Thereupon, at 4.40 o'clock p. m., the subcommittee adjourned, subject to the call of the chairman.)

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